1.2

CLEANUP ACTION PLAN

Alcoa Vancouver Potliner NPL Site
Vancouver, Washington

by
Washington Department of Ecology

February 7, 1992

42352

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DRAFT CLEANUP ACTION PLAN
ALCOA VANCOUVER POTLINER NPL SITE, VANCOUVER, WASHINGTON
February 7, 1992

INTRODUCTION

1.1 PURPOSE

This decision document presents the Cleanup Action Plan for the Aluminum Company of America (Alcoa) - Vancouver Potliner NPL site located approximately 3 miles northwest of downtown Vancouver near the VANALCO aluminum smelter. The site is located near the southeast corner of the smelter property, approximately 300 to 500 feet north of the Columbia River. The site consists of three waste piles, contaminated soil under the waste piles and subsurface contaminated strata and groundwater. The area is both industrial and agricultural. The cleanup decisions in this Cleanup Action Plan are based on data presented in remedial investigation and feasibility studies conducted by Hart Crowser for Alcoa, data from Ecology files and information presented independently by Alcoa. The Cleanup Action Plan (CAP) documents the site - specific factors and analysis that led to the selection of the cleanup remedy for the site.

The purpose of the Draft Cleanup Action Plan is to:

--- Summarize the alternative cleanup actions that were investigated in Alcoa's Remedial Investigation and Feasibility Study.

--- Describe the proposed cleanup action and rationale used to select the plan.

--- Provide an opportunity for the public to comment on the proposed cleanup action.

1.2 APPLICABILITY

This Cleanup Action Plan is applicable only to the Alcoa - Vancouver Potliner National Priorities List (NPL) Site. The cleanup levels and cleanup actions presented in this document have been developed as a result of a remediation process conducted with Department of Ecology oversight. The cleanup levels and cleanup actions are site specific. The cleanup actions should not be considered as setting precedents for other similiar sites.

Potentiality Liable Persons (PLP's) cleaning up sites independently, without Ecology oversight, may not cite numerical values of cleanup levels specified in this draft document as justification for cleanup levels in other unrelated sites. PLP's that are cleaning up sites under Ecology oversight must base cleanup levels on site specific regulatory considerations and not on the numerical values contained in this CAP.

1.3 DECLARATION

The selected remedy will be protective of human health and the environment. Ecology gives preference to permanent solutions to the maximum extent where practical. In this cleanup, treatment and recycle alternatives were examined but not used due to the nature of the material present on the site. Source control measures consist of removal of potliner to an approved hazardous waste landfill and construction of a geomembrane cover. Permanent treatment of the contaminated soils and strata was judged not practicable at this site because no practicable treatment technologies exist for treating the large volumes of cyanide and fluoride contaminated materials. Ground water pump and treat technologies were not considered appropriate for the site because contaminant loading of the Columbia River from the cyanide/fluoride treatment system would be greater than the present groundwater loading from the site. Also, the effectiveness of a pump and treat system in the most contaminated ground water zone, the semi-permeable intermediate zone, is very low. Institutional controls along with containment of contaminated soils and strata are the remedial technologies chosen for the remediation. A summary of all cleanup alternatives which were examined during the investigative phase of the feasibility study is given in the cleanup alternative section of this document.

1.4 ADMINISTRATIVE RECORD

The documents used to make the cleanup decisions discussed in this cleanup action plan constitute the administrative record for the Alcoa site. These documents are listed in Appendix A of the this document. Additional documents located in Department of Ecology Industrial Section Files in Olympia, Washington are also considered a part of the administrative record for the site.

SITE DESCRIPTION AND HISTORY

2.1 SITE LOCATION

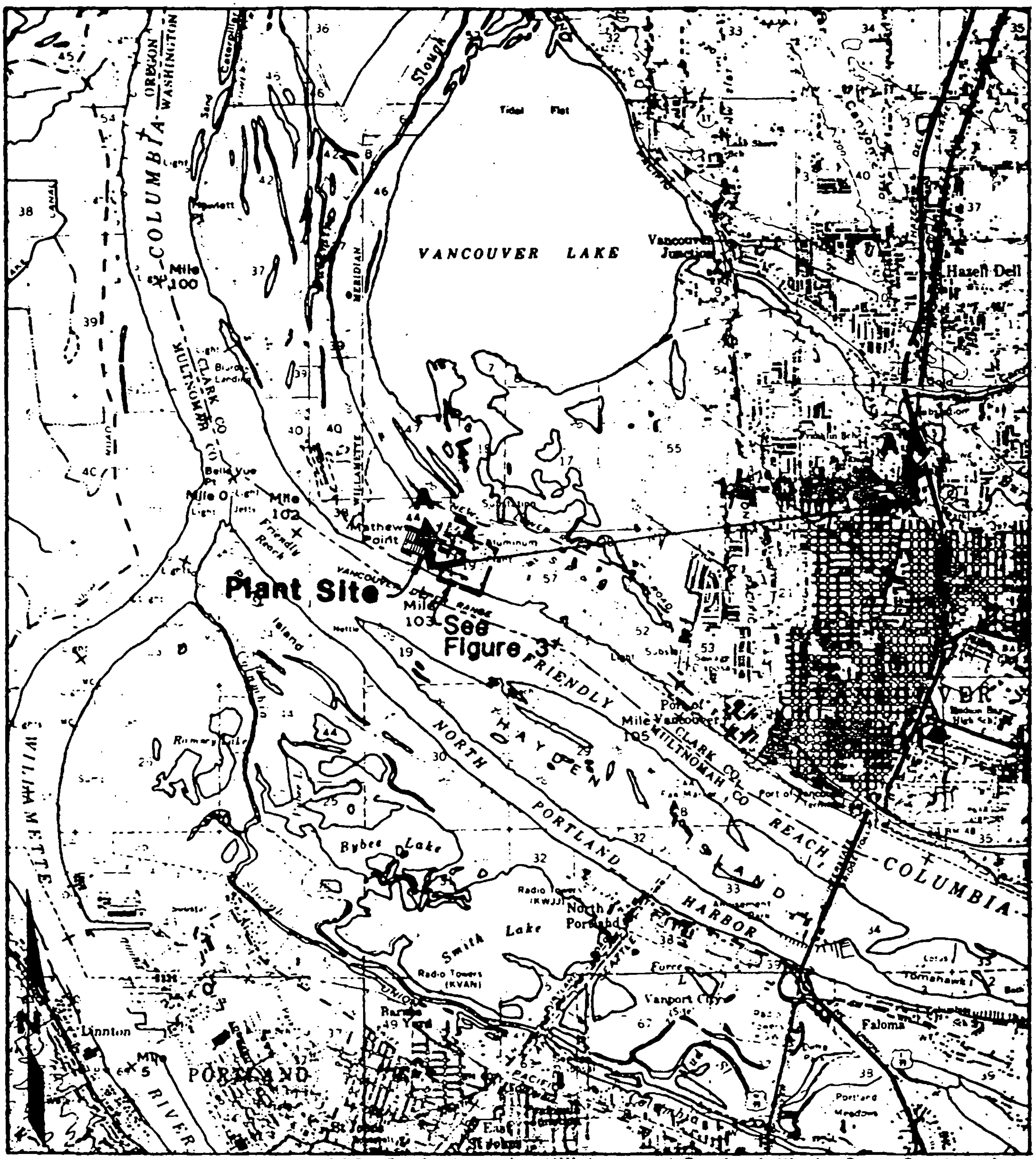
The Alcoa Vancouver NPL Site is located approximately three miles northwest of downtown Vancouver, Washington and approximately 300 to 500 feet north of the Columbia River. The Site is found at the southeastern corner of the VANALCO smelter complex located at 5701 NW Lower River Road, Vancouver. The area is both industrial and agricultural. Figure 1 shows the site location.

2.2 SITE HISTORY

The Alcoa Vancouver facility was initially constructed in 1939 and 1940. It started production of aluminum in 1940. The smelter produces approximately 325 tons of aluminum per day. It is presently owned by Vanalco, Inc.

The facility produces aluminum using the Hall-Heroult electrolytic cell process. The aluminum production process is an electrochemical reduction reaction. Aluminum oxide (alumina ore) is dissolved in a bath of molten salts (cryolite) at an operating temperature of approximately 1760 degrees F. Electric current is passed through the cell causing the reduction of the alumina to aluminum.

Vicinity Map



Note: Base map prepared from USGS 15-minute series Hillsboro and Portland, Wash.-Oreg. Quadrangles.

A A' Cross Section Location and Designation (See Figure 8)

● 27-H1 City of Vancouver Municipal Well Location

0 1 2
Scale in Miles

J-1759-02 June 1987

HART-CROWSER & associates inc.

Figure 1

The entire process occurs in a rectangular steel shell or pot that is lined with insulation materials and carbon, known as potlining. Uncontaminated alumina ore is used for a portion of the insulation. The cathode of the aluminum reduction cell is the carbon on which the pool of molten cryolite/aluminum mixture rests. The anode, in the case of the Vancouver plant, is a block of carbon suspended in the molten cryolite/aluminum bath. Alumina is periodically added to the mixture to maintain the concentration of dissolved alumina within the desired range. The aluminum is intermittently drawn off from the bottom of the molten cryolite/aluminum bath. The molten aluminum is collected in large ladles and then cast as the final products at a casthouse facility.

In order to retain purity of the aluminum product and structural integrity of the cell, molten aluminum must be kept isolated from the iron shell of the pot. Over the life of the cathode, the carbon lining materials become impregnated with the cryolite electrolytic solution. As the cryolite solution is absorbed into the cathode, the integrity of the lining can be reduced and cracks or heaving of the carbon lining can occur. A pot is used until the integrity of the lining is deteriorated by the corrosive bath and aluminum mixture. At this time the pot is drained, the carbon lining and insulation is removed and then replaced. The carbon potlining that is removed from failed pots is known as spent potlining (SPL). The SPL is a listed (K088) dangerous waste. At Vancouver smelter, the pots are not removed from the aluminum smelting building during the carbon removal and relining process. The carbon and insulation are removed in place and the steel shell is then removed for repair by an overhead crane.

The spent potlining (SPL) and reclaimed alumina insulation (RAI) materials from failed pots were temporarily stored on-site during the early years of the Vancouver smelting operation. The spent potlining was stored in the same general area now occupied by the existing waste piles. Starting in the early 1950's, the potlining was hauled off site to the Reynolds recycling facility at Longview, Washington. The potlining was loaded onto railway cars using tracks that are located next to the existing piles. The shipping of potlining for recycling purposes continued until 1973.

Recycling of potliner stopped in 1973 and between 1973 and 1981, the current waste piles were formed on the site. There are three waste piles on the site. The largest pile contains spent potlining materials that were produced between 1973 and 1978. The next largest pile contains RAI material and minor amounts of potliner that were generated between 1977 and 1978. The two piles were covered in 1978 with a 12 mil plastic liner and up to two feet of clean sand. RAI and SPL materials that were generated between 1978 and 1981 were combined into a third pile that was covered in 1981. In 1977 Alcoa installed nine shallow monitoring wells in the vicinity of the three waste piles. Sampling of these wells subsequently identified the presence of cyanide in the ground water. From 1981 until 1983 that spent potliner was shipped to the Wenatchee smelter and disposed of in a storage pile Starting in 1983 the wastes were shipped to the hazardous waste landfill at Arlington, Oregon. The Wenatchee storage pile was clean closed in 1989 and the potlining from the Vancouver smelter was disposed of in the dangerous waste landfill in Arlington, Oregon.

The Department of Ecology became aware of the site in 1981. With Ecology involvement, Alcoa installed additional monitoring wells bringing the total number of wells at the site to 30. A public meeting was held during the winter of 1982 to inform the public of the cyanide contamination at the site. In 1982, the Department felt that no further action was warranted at the site because of the mitigating actions undertaken by Alcoa. It was felt that the cover was sufficient to prevent further leaching of cyanide into the groundwater. Work and analysis of the groundwater problem completed in 1982 indicated that cyanide levels should diminish due to the covering of the waste piles.

Statistical analysis of ground water data in 1986 using chemical analyses from the period of 1981 through 1985 indicated that cyanide levels in several monitoring wells were not decreasing but instead increasing. As a result of the groundwater contamination, Ecology, through a water quality order (DE86-419), directed Alcoa to conduct a Final Assessment Report and Remedial Action Plan for the site. In August of 1986 Alcoa finished preliminary assessment of groundwater conditions at the Vancouver site. The report documented the cyanide and fluoride contamination of soils and ground water at the site. Alcoa submitted to Ecology the final Remedial Investigation and Feasibility Study (RI/FS) concerning the site in July of 1987. In 1988, Ecology reviewed the proposed remedial actions presented in the feasibility study and indicated to Alcoa that the three potliner piles could not remain in place on site, since under Washington Dangerous Waste regulations, the material was presumed to be extremely hazardous waste. As of 1988, the potliner waste in the piles had not been characterized but the approximate composition of the piles could be estimated from fresh potliner that originated from the Vancouver smelter. This potliner was classified as extremely hazardous waste due to fish bioassay failure. In 1989, Alcoa sampled and analyzed potliner from the three waste piles. The potliner was characterized as dangerous waste due to failure of the rat bioassay test. The material passed the EP Tox leach test for metals and one sample out of 24 samples failed the fish bioassay test. In 1990, Alcoa agreed to move the three waste piles to a secure hazardous waste facility and remediate the site. In January of 1991 Alcoa delivered to Ecology a proposed consent decree for the cleanup of the site.

In 1985 EPA completed a Preliminary Assessment and ranked the site. The site scored (57.87) high enough to be nominated to the NPL. EPA began the process to place the site on the NPL in 1985. The site was listed on the NPL in February of 1990.

Staff from the Agency for Toxic Substances and Disease Registry (ATSDR) conducted a site visit in March of 1989. The Agency reviewed data from Ecology files and the site RI/FS submitted by Alcoa. Based on the reviewed information, ATSDR concluded the site is of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects. The Agency recommended that the following items be included in any cleanup actions at the site to lower the exposure potential to the public. The remedial action should be designed to prevent infiltrations of water into the piles and if the piles were moved ambient air sampling should be done to protect on site workers from a potential release of ammonia. Ground water monitoring should be continued and the Columbia River should be sampled to determine contaminant concentrations entering the river. The Agency in its evaluation did not find any extant documentation or indication in the information and data reviewed for the health assessment that human exposure to contaminants at levels of public health concern has occurred or is occurring. The ATSDR does not plan to conduct follow up health studies because no significant public health concerns have been documented on the site. If data become available suggesting that human exposure to significant levels of hazardous substances is currently or has occurred in the past, ATSDR will reevaluate the site. The cleanup alternative selected for the site addresses all of the concerns of the ATSDR.

2.3 CURRENT STATUS

The site is currently surrounded on the northern and western boundaries by an active aluminum smelter. The smelter domestic waste water treatment plant is located on the southeastern side of the site. The site is located within the flood control dike system that surrounds the smelter. Storm water is drained from the site by a series of storm drains and catch basins. The storm water system is connected to the plant waste water treatment system and is regularly monitored under the NPDES Permit issued to Alcoa for the smelter operation.

2.4 FUTURE USE

The Alcoa site has been used for industrial purposes since World War Two, and is currently zoned for heavy industry. Future use of the site is unknown at this time. The existing aluminum smelter located west of the site continues to operate. The property east of the site is being purchased by the Port of Vancouver. Development plans for this property are unknown. The area is changing from a mixture of agriculture and heavy industry to commercial and heavy industry.

RESULTS OF ENVIRONMENTAL STUDIES

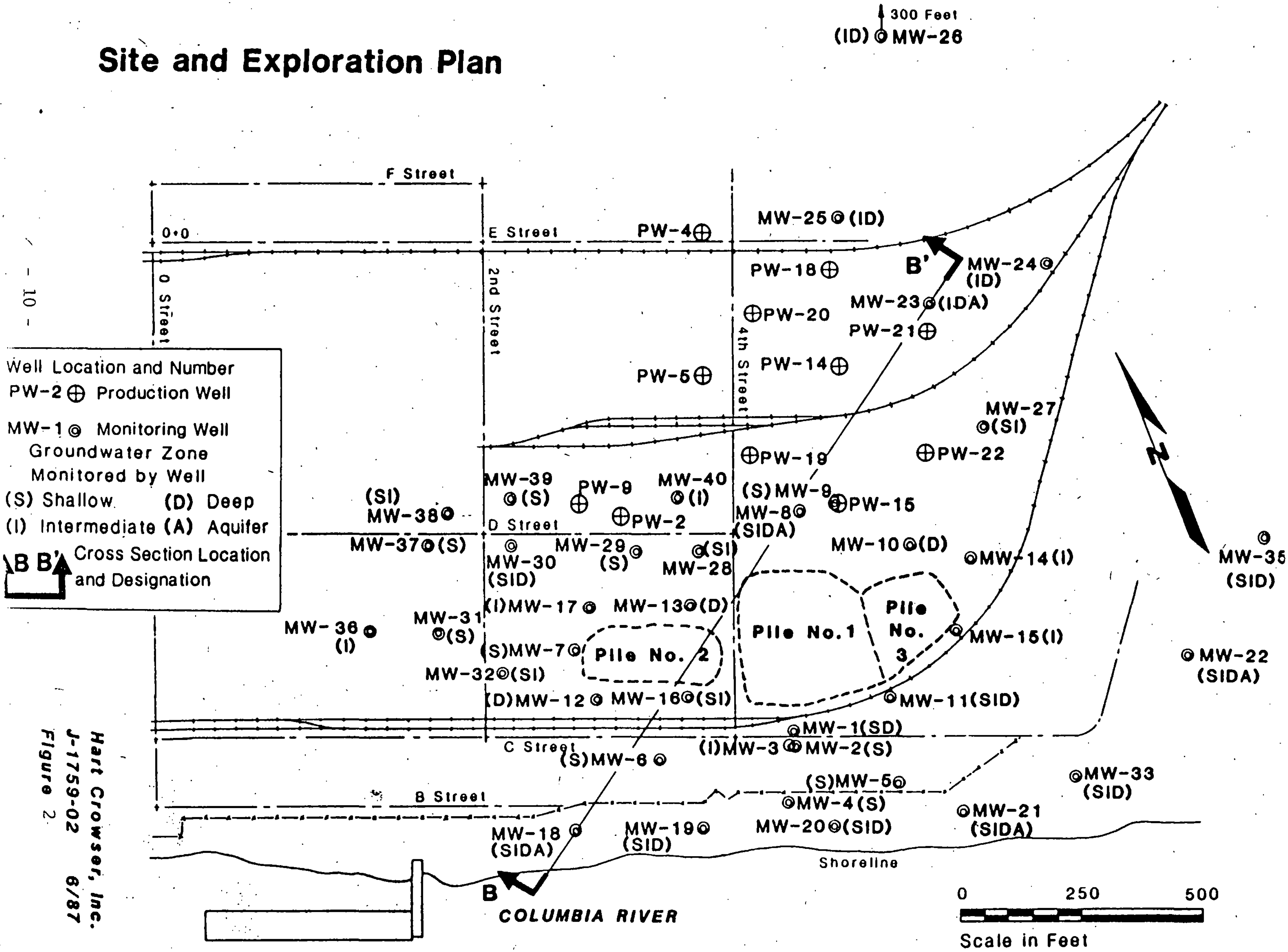
3.1 SITE CHARACTERIZATION

3.1.1 Surface Soil and Water Characterization.

The waste piles are located on the Columbia River lowland (Figure 2). The ground surface in the vicinity of the site is relatively flat with elevations increasing from approximately 20 feet in the south along the river to 30 to 40 feet in the northern and eastern portions of the plant. The major topographic features of the plant site are the covered waste piles and flood control dikes. Surface water occurs on site as a result of precipitation. Surface drainage in the immediate vicinity of the waste piles is generally to the south toward a low area that contains a perforated pipe drainage system. The water flow from the perforated pipes discharges into a sump which is connected to the aluminum plant water treatment system. The flood control dikes that surround the plant generally keep all surface water drainage on the plant site and directed to the plant water treatment system.

Analysis of standing surface water around the piles range from < .005 mg/l to .031 mg/l. cyanide. All surface water drainage around the site is directed into

Site and Exploration Plan



Hart Crowser, Inc.
J-1759-02 6/87
Figure 2

the plant water treatment system. Analysis of the Columbia River in the vicinity of the piles is <.005 mg/l cyanide both down and up stream of the site. Fluoride measurements in the Columbia River up stream of the site are higher (.16 mg/l) than those measurements down steam of the site (.15 mg/l). U.S.G.S. data of the Columbia River at The Dalles, Oregon ranges from .10 to .70 mg/l fluoride. U.S.G.S. water quality data from the Columbia River at Bradwood, Oregon below both the Reynolds smelter at Longview, WA and the Vanalco smelter at Vancouver ranges from 0.1 to 0.7 mg/l fluoride.

Data collected during the preliminary assessment indicates that small amounts of potlining may be present in the soils east and west of the waste piles. Detailed sampling for cyanide and fluoride was conducted southeast of the waste piles. In this area total cyanide values in soil range from < 0.10 mg/kg to 0.44 mg/kg and fluoride values range from < 2.0 mg/kg to 43.0 mg/kg. There has been no surface soil sampling under the waste piles. Soil sampling under the three piles will be completed during the remediation.

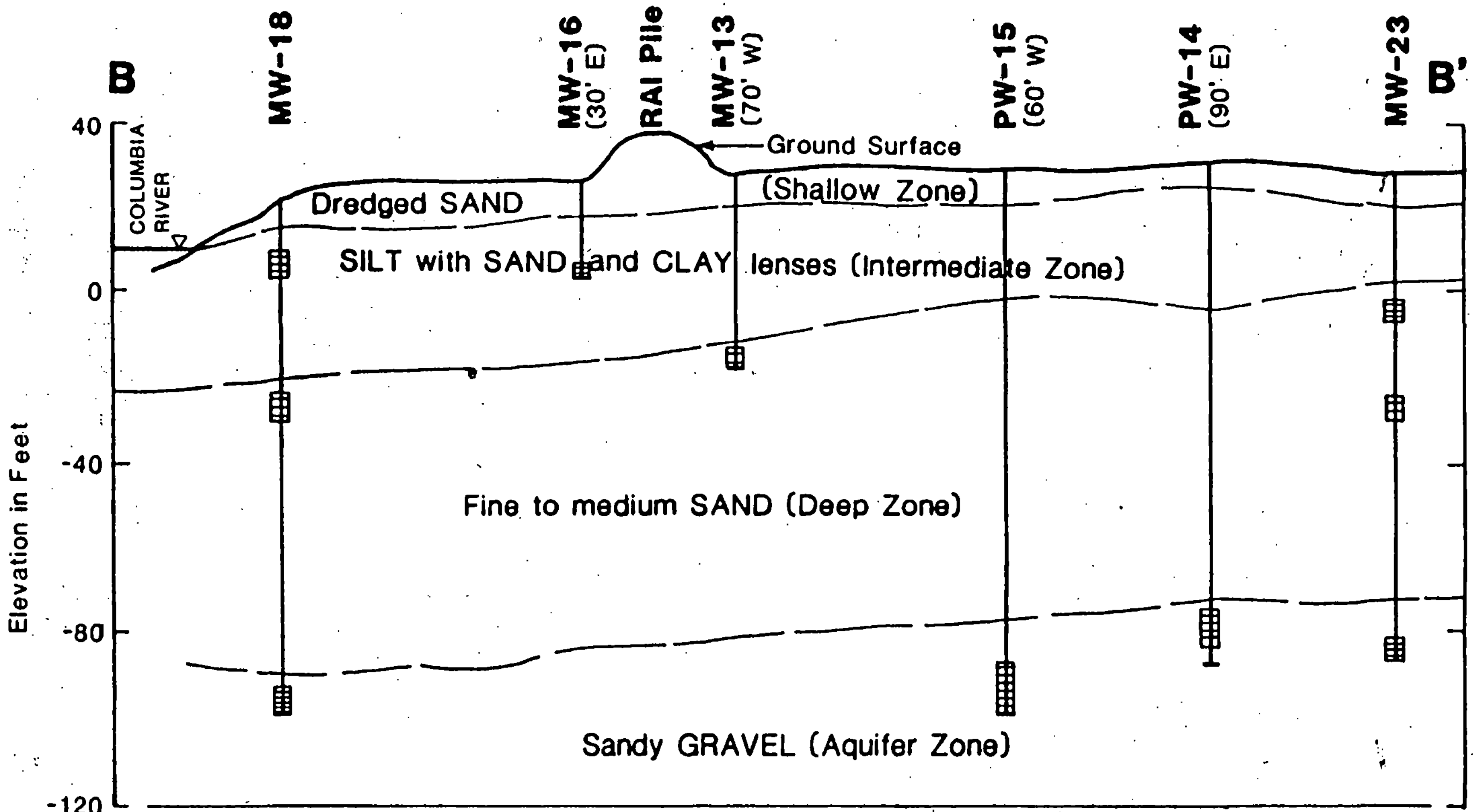
Sampling of soils from the shallow zone borings shows contamination in the vicinity of the piles generally southward to the Columbia River. The shallow zone consists of material from the surface to a depth of 10 feet. Average soil sample values in the shallow zone range from non detection to 3.17 mg/kg cyanide and from 5.00 mg/kg to 1300 mg/kg fluoride. Spot high values are near 1500 mg/kg fluoride and 55.9 mg/kg cyanide. One outlier sample contains 6900 mg/kg fluoride. The area of shallow zone fluoride contamination spreads from the piles southward to the Columbia River and northwestward toward the plant. The outlier sample (6900 mg/kg fluoride) is thought to be a result of surface contamination of the sample with potliner material. The shallow zone cyanide contamination spreads southeastward to the Columbia River but does not appear to follow the fluoride soil contamination northward to the plant.

3.1.2 Hydrogeologic and Subsurface Sediment Characterization.

The groundwater system at the site can be divided into four general zones: the shallow zone, the intermediate zone, the deep zone and the aquifer zone (Figure 3). The shallow zone consists of approximately 10 feet of dredged sand. The intermediate zone consists of 30 to 40 feet of silt with lenses of clay and fine sand. The top of the intermediate zone was the original ground surface before the dredged sands were placed over the site. The deep zone consists of fine to medium sand approximately 40 feet thick. The aquifer zone is comprised of coarse sand and gravel between 100 and 140 feet below the surface. Figure Two shows monitoring well locations on the site. Detailed sampling information for soil and water is given in Appendix B.

During the wetter months of the year ground water becomes perched in the dredged sands of the shallow zone. This perched ground water initially drains to low spots in the original site topography. After the low spots become filled with water, the ground water flows are toward the Columbia River. The flow directions in the material change due to amount of water in the unit. The horizontal hydraulic conductivity of the dredged sands is in the range of 10^{-3} to 10^{-4} cm/sec. Good aquifers generally have hydraulic conductivities of 10^{-3} to 1. Sediments in the shallow zone are contaminated by fluoride and cyanide. Levels

Generalized Hydrogeologic Units



Note: Stratum lines are based upon interpolation between explorations and represent our interpretation of subsurface conditions based on currently available data.

MW-18 Monitoring Well Number

PW-15 Production Well Number
(60' W) Offset Distance and Direction

Well Location

Screen Section

Vertical Exaggeration x 5

Horizontal Scale in Feet
0 200 400

0 40 80
Vertical Scale in Feet

Hart Crowser, Inc.
J-1759-02 6/87
Figure 3

of contamination in sediment of the zone range from average concentrations of 14.5 to 3450 mg/kg fluoride and .005 to 282 mg/kg total cyanide. Total cyanide and fluoride concentrations from one soil and two water sampling events (1986 and 1907) are given in Appendix B.

The flow through the intermediate zone silts is primarily vertical. The presence of contamination in this unit is due to downward flow from the shallow zone sands and the potliner piles rather than horizontal flow. The horizontal hydraulic conductivity of the intermediate zone silt is 10^{-4} to 10^{-6} cm/sec. Poor aquifers generally have hydraulic conductivities of 10^{-3} to 10^{-6}. Laboratory tests of the intermediate zone indicate that vertical conductivities of 10^{-7} to 10^{-8}. The ability of the small individual sand and silt units in the zone to produce water is highly variable. The two pump tests well were completed in the zone show this variability. The pump test wells were placed approximately 220 feet apart. The first test well did not produce water after bailing (< 0.07 gpm) while the second test recovered quickly after bailing and produced greater than five gallons per minute during the test. Hydraulic conductivity was calculated to range from 1.11×10^{-2} to 1.8×10^{-2} in the second well. Hydraulic conductivities of good aquifers range from 10^{-3} to 1 cm/sec. Sediments in the zone are contaminated by cyanide and fluoride. Levels of cyanide in sediments average from non detection to 91.9 mg/kg and levels of fluoride in sediments average from 3.9 to 1270 mg/kg. Detailed sampling data for two sampling events is given in Appendix B.

Ground water flow directions in the deep sand zone are south toward the Columbia River. Chemical dispersion data also indicates a flow direction to the south. Continuous water level measurements taken in the deep zone indicate that Columbia River tidal influence is present in the hydrologic unit. The hydraulic conductivity of the deep zone sand unit is 10^{-2} to 10^{-4} cm/sec. This represents values commonly found in good aquifers. The deep zone shows low concentrations of cyanide and fluoride in sediments. Cyanide averages in sediments range from non detection to 1.48 mg/kg and fluoride averages in sediments range from 2.3 to 22.6 mg/kg. Detailed sampling data for cyanide and fluoride in the deep zone is given in Appendix B.

Ground water flow directions in the aquifer zone are to the southwest, similiar to flow directions in the deep zone. There are two external influences on flow directions in the aquifer zone, the Columbia River and the Alcoa water supply wells. The production wells are located 100 to 140 feet north of the potliner piles. Data from pumping tests in 1954 indicate that the transmissivity of the aquifer zone ranges from two to four million gallons per day per foot. This is a very high value. Calculations of drawdown in the aquifer below the waste piles using the pumping data predict a 1.5 foot change due to pumping. The flat cone of depression predicted with the Theis analysis of drawdown indicates that the pumping activity will not significantly effect the flow directions of water deposits overlying the site. The pumping analysis also shows that the aquifer and deep zones behave independently as separate hydrologic units. The Columbia River has more influence on the hydrologic unit than the production wells. Continuous water level measurements of the aquifer zone show diurnal tidal fluctuations. The hydraulic conductivity of the aquifer zone in 10^{-2} to 10^{-3} cm/sec. Sediments from the aquifer zone have very low concentrations of cyanide and fluoride. The average concentrations of cyanide in sediments from the aquifer zone range from non detection to .075 mg/kg. The average concentrations of fluoride in sediments in the zone range from 1.7 to 4.65 mg/kg. Detailed sampling data from water and soils in the aquifer zone is given in Appendix B.

3.1.3 Waste Pile Characterization.

Approximately 66,000 tons of waste materials are reported by Alcoa to remain on site in three waste piles. Of the 66,000 tons of material, approximately 10,000 tons of the material is present in a reclaimed alumina pile, approximately 48,000 tons of the material is found in the large potlining pile and approximately 8,000 tons is found in the second potlining pile. No detailed chemical analysis of spent potlining or reclaimed alumina insulation from the waste piles has been completed to date. Only selected chemicals of concern have been analyzed. The approximate composition of the material can be estimated based on the knowledge of the composition of fresh potlining from the Vancouver smelter. Fresh potlining consists primarily of carbon, fluoride, oxides and nitrides, aluminum and sodium with minor amounts of calcium, silica, iron and cyanide. Reclaimed alumina insulation consists primarily of aluminum oxide. Selected analysis for cyanide of SPL from the three piles indicated that the potliner contains between 60 and 3500 mg/kg total cyanide. RAI material contains between 170 to 3400 mg/kg total cyanide.

At the time of the remedial investigation and feasibility study, no detailed sampling or dangerous waste testing of the materials in the piles had been completed. The piles were thought to contain material that was designated extremely hazardous waste based on tests conducted on freshly generated material in 1982 and 1983. Several years after the completion of the remedial investigation, Alcoa set up a sampling program to drill each pile and an analytical program to collect samples for dangerous waste characterization. Alcoa tested the material using EP Tox leach procedure, fish bioassay, and acute oral rat toxicity testing. Table One shows the results of this testing program. Alcoa collected 24 large composite rotary drill samples for testing. All but one sample out of twenty four passed both levels of the fish bioassay procedure. One sample failed the 1000 mg/L fish bioassay but passed the 100 mg/L bioassay. All samples passed the EP Tox test and passed the 500 mg/ kg oral rat toxicity test. All seven of seven samples failed the 5 gm/kg oral rat toxicity test. The data is summarized in Table Two. Due to the failure of the oral rat toxicity test, the material is classified DW by Washington State Dangerous Waste Regulations.

3.2 CHEMICALS OF CONCERN AND RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

During the RI/FS, Alcoa performed chemical analysis on the waste pile material, soil near the piles, surface water, and ground water. Analysis of the spent potliner and site soils for selected chemicals and the site ground water for priority pollutant chemicals revealed three major chemicals of concern, trichlorethene, fluoride and cyanide. Cyanide and fluoride were found in potliner, soils and ground water while trichlorethene was only found in ground water. Priority pollutant analyses of ground water indicated low concentrations of several other organic chemicals and metals. The ground water analyses were divided into five groups by test method; volatile organics, semi-volatile organics, pesticides and PCB's, cyanide, and metals analysis.

TABLE 1

Vancouver Spent Potlining Analytical Results

SAMPLE IDENTIFICATION	Total CN solid phase (mg/Kg)	D.I. LEACH TOTAL CYANIDE (mg/L)	D.I. LEACH @ FREE CYANIDE (mg/L)	150 L FISH BIOASSAY 100mg/L DEATHS	150 L FISH BIOASSAY 1000mg/L DEATHS	15 L FISH BIOASSAY 100mg/L DEATHS	15 L FISH BIOASSAY 1000mg/L DEATHS	RAT ORAL TOXICITY 500mg/kg DEATHS	RAT ORAL TOXICITY 5g/kg DEATHS
SPL-1-SW Upper	960	38	1.2	** 0	0	NP	NP	NP	NP
SPL-1-NW Lower	990	43	1.6	0	1	NP	NP	0	9
SPL-1-NE Upper	690	13	0.95	0	0	0	0	NP	NP
SPL-1-SE Lower	960	44	2.2	0	1	NP	NP	0	9
SPL-3-SW Upper	80	0.44	0.39	0	0	1	0	NP	NP
SPL-3-NW Lower	250	2	1.5	1	1	NP	NP	0	10
SPL-3-NW Lower(dup)	250	4.9	1.5	--	--	--	--	--	--
SPL-3-NE Upper	800	35	4.9	0	0	NP	NP	0	9
SPL-3-SE Upper	140	1.8	1.8	0	0	NP	NP	NP	NP
RAI-2-SW Upper	380	5.5	4.2	* 1	2	NP	NP	0	10
RAI-2-NW Lower	2700	71	16	0	13	0	10	0	10
RAI-2-NW Lower(dup)	2300	71	18	--	--	--	--	--	--
RAI-2-NE Lower	230	4.6	1.9	0	1	NP	NP	NP	NP
RAI-2-SE Upper	170	8.6	2.7	1	0	NP	NP	NP	NP
Background Upper	18	< .01	< .01	* 1	0	NP	NP	0	0
RCRA THRESHOLD									
SPL-1-SW Lower	1800	72	0.04	NP	0	NP	NP	NP	NP
SPL-1-NW Upper	620	13	<.01	NP	1	NP	NP	NP	NP
SPL-1-NE Lower	2400	74	1.6	NP	2	NP	NP	NP	NP
SPL-1-SE Upper	3500	26	4.7	NP	5	NP	NP	NP	NP
SPL-3-SW Lower	100	1.8	0.7	NP	1	NP	NP	NP	NP
SPL-3-NW Upper	60	0.19	0.39	NP	0	NP	NP	NP	NP
SPL-3-NE Lower	2600	65	2.5	NP	0	NP	NP	NP	NP
SPL-3-SE Lower	130	0.77	0.22	NP	1	NP	NP	NP	NP
RAI-2-SW Lower	770	16	5.5	NP	4	NP	NP	NP	NP
RAI-2-NW Upper	2900	67	12	NP	0	NP	NP	NP	NP
RAI-2-NW Upper(dup)	3400	83	11	NP	--	--	--	--	--
RAI-2-NE Upper	340	22	2.2	NP	1	NP	NP	NP	NP
RAI-2-SE Lower	1800	38	6	NP	0	NP	NP	NP	NP
Background Lower	2	<.01	<.01	NP	0	NP	NP	NP	NP
STATE THRESHOLD				21	11	11	11	3	3

SAMPLE IDENTIFICATION	REACTIVE CYANIDE (mg/Kg)	REACTIVE SULFIDE (mg/Kg)	EP TOX LEACHATE CONCENTRATIONS As (mg/L)	Ba (mg/L)	Cd (mg/L)	Cr (mg/L)	Pb (mg/L)	Hg (mg/L)	Se (mg/L)	Ag (mg/L)
SPL-1-SW Upper	4	< 10	< .008	< .008	< .004	0.024	< .07	< .0002	0.004	< .008
SPL-1-NW Lower	< .5	< 10	0.026	0.111	< .004	0.028	< .07	< .0002	< .003	< .008
SPL-1-NE Upper	14	< 10	< .003	0.022	< .004	0.037	< .07	0.0003	< .003	< .008
SPL-1-SE Lower	3.6	140	0.024	< .008	< .004	0.014	< .07	0.0007	0.013	< .008
SPL-3-SW Upper	4.3	14	< .003	0.403	0.019	0.011	< .07	< .0002	< .003	< .008
SPL-3-NW Lower	12	19	< .003	0.418	0.011	0.027	< .07	< .0002	< .003	< .008
SPL-3-NW Lower(dup)	12	40	< .003	0.577	0.014	0.02	< .07	< .0002	< .003	< .008
SPL-3-NE Upper	9.4	15	0.054	0.028	< .004	0.014	< .07	< .0002	< .003	< .008
SPL-3-SE Upper	14	< 10	< .003	0.898	< .004	< .007	< .07	< .0002	< .003	< .008
RAI-2-SW Upper	20	20	0.004	0.042	< .004	< .007	< .07	0.0003	< .003	< .008
RAI-2-NW Lower	19	< 10	0.015	0.098	< .004	0.009	< .07	0.0004	0.03	< .04
RAI-2-NW Lower(dup)	--	--	--	--	--	--	--	--	--	--
RAI-2-NE Lower	6.1	< 10	0.004	0.387	0.008	0.012	< .07	0.0004	0.003	0.011
RAI-2-SE Upper	7.6	< 10	0.03	0.05	< .004	0.012	< .07	< .0002	< .003	< .008
Background Upper	< .5	15	< .003	0.437	0.004	< .007	< .07	< .0002	< .003	< .008
RCRA THRESHOLD	250	500	5	100	1	5	5	0.2	1	5

Analytical notes:
@ cyanide by microdiffusion
* 1 additional by jumping out of tank
** 5 additional by jumping out of tank
NP; Not Performed

Keith D. Schmidt revised 90-05-11

There are six media of concern which may pose risks to human health or the environment at the Alcoa site. These are contaminant wastes (potliner), soil, ground water, sediment (soils found beneath the surface of water bodies), surface water, and air. The interim action of covering the potliner piles with a 12 mil plastic cover and two feet of sand has reduced the immediate environmental risk of the cyanide and fluoride from the potliner wastes and the generation of hydrogen cyanide from the breakdown of cyanide complexes in the potliner. The soil, ground water, sediment and surface water media have not been addressed to date.

3.2.1 Potliner Analysis.

Fresh potliner from the Vancouver smelter has been characterized using the EP Toxicity technique, chemical testing, rat bioassay, and fish bioassay. The chemical testing of potliner indicates that there are two chemicals of concern: fluoride and cyanide. Results from the potliner chemical testing are given in Table One. Rat bioassays indicate that the potliner is dangerous waste.

3.2.2 Soil Analysis.

Subsurface soil samples were collected during the installation of ground water monitoring wells on the site. Laboratory analyses were preformed on 99 soil samples. The soils were analyzed for cyanide and fluoride. Additional near surface soil samples and catch basin samples were also collected from the site and analyzed for cyanide and fluoride. Soil samples from the shallow and intermediate zones show significant cyanide and fluoride contamination. Samples from surface soil samples show some cyanide and fluoride contamination. The surface soil sampling program is incomplete. Soil samples from under the waste piles will be collected after the waste piles are removed during the remediation.

3.2.3 Surface Water Analysis.

Standing surface water in the vicinity of the waste piles was analyzed for total cyanide. Values range from less than 5 ppb to 37 ppb total cyanide. Samples of the Columbia River at the site and up-steam from the site were also collected. The Columbia River analysis was less than 5 ppb total cyanide.

3.2.4 Ground Water Analysis.

Ground water is collected from 19 monitoring wells and four production wells quarterly and analyzed for total cyanide, free cyanide, and fluoride. Eleven monitoring wells were analyzed for priority pollutants during the RI/FS. Samples were analyzed for priority pollutants in accordance with Test Methods of Evaluating Solid Waste (SW-846). A complete list of the analytes that were tested is given in the RI/FS. The specific chemicals detected in the priority pollutant chemical scan above trace amounts are given below in Table Two.

TABLE TWO
Ground Water Priority Pollutant Analysis

Hydrologic Zone	Contamination Range Low ug/L	Contamination Range High ug/L	Number of Wells Detected	Number of Wells Sampled
<u>Shallow Zone</u>				
Organics				
Acetone	L/1	17	1	2
Bis (2-ethylhexl) Phthalate	L/1	2	1	2
Endrin acetone	L/0.04	0.04	1	2
Metals				
Arsenic	L20.0	40.0	1	2
Cadmium	L 1.	1.	1	2
Chromium	L 1.	4.	1	2
Copper	25.	43.	2	2
Nickel	L 2.	23.	1	2
Zinc	13.	32.	2	2
Total Phenol	L 5.	--	0	2
<u>Intermediate Zone</u>				
Organics				
Methylene Chloride	Trace	140.	4	4
Acetone	6.	28.	4	4
Naphthalene	L 1.	3.	1	4
2-methylphenol	L 1.	19.	1	4
Metals				
Arsenic	L20.	350.	3	4
Cadmium	L 1.	L10.	0	4
Chromium	L 1.	48.	3	4
Copper	10.	240.	4	4
Nickel	L 2.	52.	2	4
Zinc	26.	65.	4	4
Total phenol	L 5.	100.	3	4

Deep Zone

Organics

Methylene chloride	53.	73.	2	2
Acetone	8.	9.	2	2
Bis (2 methylhexyl) phthalate	6.	13.	2	2

Metals

Arsenic	L20.	L20.	0	2
Cadmium	L 1.	L 1.	0	2
Chromium	L 1.	L 1.	0	2
Copper	2.	3.	2	2
Nickel	L 2.	L 2.	0	2
Zinc	15.	36.	2	2
Total phenol	L 5.	L 5.	0	2

Aquifer Zone

Organics

Trichloroethylene	L 1.	20.	1	2
Endrin Ketone	L 0.04	0.13	1	2

Metals

Arsenic	L20.	L20.	0	2
Cadmium	L 1.	L 1.	0	2
Chromium	L 1.	L 1.	0	2
Copper	3.	3.	2	2
Nickel	L 2.	L 2.	0	2
Zinc	17.	54.	2	2
Total phenol	L 5.	L 5.	0	2

Alcoa is examining the ground water contamination of trichloroethylene (TCE) as a separate Model Toxics Control Act clean up. An RI/FS is currently being conducted on the site. The source of the TCE contamination appears to be a separate site adjacent to the NPL site.

3.2.5 Cyanide and Fluoride Contaminant Sources.

There are three possible fluoride and cyanide contaminant sources at the site. These include 1) the waste piles 2) waste materials mixed with soil in the vicinity of the waste piles and 3) contaminants previously absorbed onto soil that are now being released.

One contamination source is the potliner pile itself. Significant amounts of precipitation may infiltrate into potlining and RAI materials under the present conditions. Run off collects along the base of the piles and likely infiltrates into the waste piles. The top liner is torn and separated in several places on the piles. Water can infiltrate along these leaks in the liner.

A second source of contamination is a small amount of potliner that is mixed with soil near the piles. Data indicates that small amounts of potliner and RAI materials are located in the soils east and west of the waste piles.

A third source of the contamination are soils beneath and down gradient of the piles that many have absorbed contaminants from the ground water before the piles were covered.

It is likely that all three sources of contamination contribute to the ground water degradation at the site. The largest source, by several orders of magnitude, is the result of rain water infiltration into the waste piles.

3.3 MEDIA CLEANUP LEVELS

3.3.1 Selection of Method for Establishing Cleanup Levels

The Model Toxics Control Act Cleanup Regulation provides three methods for determining cleanup levels at a contaminated site. The methods are known as Method A, Method B, and Method C. Method A applies to relatively straight forward sites that involve only a few hazardous substances. The method defines cleanup levels for 25 of the most common hazardous substances. The method also requires that the cleanup meet promulgated federal and state regulations such as maximum contaminant levels established by the clean water act. Method B is a standard method that can be used at all sites. The clean up levels are set using a site risk assessment which focuses on site characteristics or concentrations of individual hazardous substances established under applicable state and federal laws. Method C is similiar to Method B. The main difference is that the life time cancer risk is set at a lower number. The method can be only used when either Method A or Method B are technically impossible, the site is defined as an industrial site, or where the attainment of Method A or B cleanup levels has the potential for creating a significantly greater overall threat to human health and the environment. In addition, Method C also requires that the person undertaking the action comply with all applicable state and federal laws.

The Alcoa site is not considered a routine site where Method A can be used. The two contaminants of concern, fluoride and cyanide are not found in the Method A table. Method C can not be used on the site because the site is not defined as a MTCA industrial site, Method B levels are not technically impossible to achieve at the site, and achieving Method B levels will not cause greater environmental harm than not achieving them. Only Method B can be used at the site. The contaminants of concern at the site are cyanide and fluoride. Method B levels for the cleanup are discussed below.

3.3.2 Ground-Water Cleanup Levels

The groundwater cleanup levels at the Alcoa site were set according to WAC 173-

340-720, "Ground Water Cleanup Standards". The ground water at the site is regulated as a source of drinking water. Method B, WAC 173-340-720 (3) (a) (i) establishes levels using concentrations established under applicable state and federal laws, including the requirements in subsection 2 (a) (ii). Subsections 2 (a) (ii) requires cleanup standards as stringent as concentrations established in applicable state and federal laws including the Safe Drinking Water Act maximum contaminant levels (MCL), the Safe Drinking Water Act maximum contaminant level goals for noncarcinogens, and the maximum contaminant levels established by the state board of health. There is no promulgated federal maximum contaminate level (MCL) for cyanide. The Safe Drinking Water Act maximum contaminant level for cyanide is proposed as 0.20 mg/l (55 Fed. Reg. 30370 (1990)). The analytical method used in the July proposed rule was total cyanide. In November of 1991 the method of measuring cyanide in the proposed rule was changed from total cyanide to cyanide amenable to chlorination. The analytical method to be used for the determination of cyanide is SM 4500-CN-G or cyanide amenable to chlorination. The Method B level of 0.2 mg/l cyanide amenable to chlorination as established by the proposed MCL for cyanide is the regulatory limit that shall be used as the cleanup standard in the Alcoa cleanup. The Safe Drinking Water Act maximum contaminant level for fluoride has been established at 4.0 mg/l. The level of 4.0 mg/l fluoride shall be used as the cleanup standard at the Alcoa site for fluoride. The ground water point of compliance for the Alcoa Vancouver site is the entire site.

3.3.3 Surface Water

All surface water from the Alcoa site is collected within the site and discharged via pipes and ditches into the nearby aluminum smelter storm water drainage system. The smelter site, including the waste piles, is surrounded by a dikes. The storm water drainage system moves water that originates in the smelter out of the dike system and into the Columbia River. The drainage system is regulated through the aluminum smelter NPDES permit. The current permit limit for cyanide is .15 lbs/day monthly average with a daily maximum of 0.4 lbs./day. The flow rate entering the Columbia River from the smelter is 2.2 to 4.5 million gallons per day (mgd). This will result in monthly average cyanide concentrations in the waste water outfall of 0.0081 mg/l at 2.2 mgd and 0.004 mg/l at 4.5 mgd; and daily maximum cyanide concentrations of 0.0218 mg/l at 2.2 mgd and 0.0107 mg/l at 4.5 mgd. The current permit limit for fluoride is 100 lbs/day monthly average with a daily maximum limit of 200 lbs/day. This will result in monthly average fluoride concentrations in the waste water outfall of 5.45 mg/l at 2.2 mgd and 2.66 mg/l at 4.5 mgd; and daily maximum fluoride concentrations of 10.9 mg/l at 2.2 mgd and 5.33 mg/l at 4.5 mgd.

The smelter November 1987 to March 1989 fluoride average was 35.7 lbs./day with a monthly range of 21.1 to 85.3 lbs/day. The flow rate during this period averaged 3.3 mgd with a monthly range of 2.2 mgd to 4.0 mgd. This will result in a monthly average fluoride concentration of 1.297 mg/l with range of 1.150 mg/l to 2.557 mg/l. These numbers do not consider any individual daily maximum loadings, only monthly averages.

It is not expected that storm water originating from the remediated site will cause permit violations. For the purposes of the cleanup, the surface water from the site will be regulated via the NPDES Permit.

3.3.4 Soil Cleanup Levels.

There are no soil cleanup standards established for the site. Contaminated soils presently exist under the potliner piles. These contaminated soils will be contained using a 40 mil PVC liner covered by clean soil and vegetation. There will be no direct contact exposure routes to contaminated soils on the site when the remediation is complete. The ground water exposure route for vadose soils under the piles will be limited by the cover system. The MTCA Regulation requires that where containment is selected, a compliance monitoring plan must be designed to ensure the long-term integrity of the containment system. Long-term monitoring and institutional controls (deed restrictions) will be implemented to assure the integrity of the cover system. Deed restrictions will not be removed from the site until applicable cleanup standards for soils are met.

SUMMARY OF ALTERNATIVE CLEANUP ACTIONS

4.1 INTRODUCTION

This section of the CAP summarizes the cleanup actions considered by Alcoa in the Feasibility Study. The Feasibility Study was completed in 1987 prior to the enactment of the Model Toxics Control Act. The Feasibility Study follows guidelines established by the Environmental Protection Agency (EPA) for Superfund Cleanup activities. The method used in the Feasibility Study is compatible and consistent with the Model Toxics Control Act. Hence, actions selected in the Feasibility Study will comply with both Chapter 173-340 WAC, Model Toxics Control Act Cleanup Regulation and the Federal cleanup regulations.

The approach used to develop and evaluate remedial action alternatives included:

- Identifying and evaluating general response actions and possible remedial action technologies;
- Selecting the applicable technologies;
- Developing and evaluating remedial action alternatives from the different technologies.

Each individual component of a remedial action alternative was evaluated as to its individual components:

- Technical feasibility;
- Public and Environmental Health Impacts;
- Institutional Feasibility;

- Cost; and

- Effectiveness

The primary objective of the remedial actions is to minimize the generation of leachate, control the migration of contamination to the water table and reduce contamination migration to the Columbia River.

4.2 GENERAL RESPONSE ACTIONS

General Response Actions can be grouped into those actions which address either source control or manage contaminant migration via groundwater flow. Source control actions include:

- Preventing contact and infiltration of incident precipitation through waste materials and contaminated soil; and

- Controlling surface water run-on.

Management of contamination migration actions include:

- Groundwater diversion; and

- Pumping and treating.

4.3 REMEDIAL ACTION TECHNOLOGIES

Alcoa's detailed analysis of possible remedial action technologies is given in Chapter 3 and Chapter 4 of the site Feasibility Study. The rationale for inclusion or exclusion was based on implementation difficulty, contaminant characteristics, reliability of technology, health/safety factors and economics. Removal of contaminated soils below the waste piles was not considered a practicable remedial action technology because the cost removing the contaminated soils below the piles and within the water table was substantially disproportionate to the degree of protection that would be achieved by the action. Based on the screening of possible technologies, the following were considered to be applicable to the site conditions.

- o <u>Capping</u> (synthetic membrane, clay/soil admixtures, and asphalt) This would minimize the generation of leachate and subsequent contaminant migration to the water table by preventing incident precipitation from contacting the waste.

- o <u>Waste Removal</u> (landfilling, incineration, or treating in a fluid bed) This would eliminate the primary source of cyanide and fluoride from the site.

- o <u>Grading, Vegetation, and Site Paving</u> This would divert run-off and minimize infiltration into contaminated soils.

- Ditching and Culverting This would minimize water infiltration into contaminated soil by diverting run-off out of the area.

- Groundwater Diversion (slurry wall) This would slow down but not eliminate contaminant migration to the Columbia River.

- Groundwater Pumping and Treatment This would reduce contaminant migration but would not reduce contaminant loading to the Columbia River because the treatment effluent has a higher concentration of contaminants than the groundwater that is presently flowing into the river from the site.

The following remedial action technologies were examined and excluded from further investigation.

- Temporary Storage.

- Ground water diversion using steel sheet piling and chemical or grout injections.

- Physical treatment of waste and contaminated soils below the piles using solidification, gravity thickening, vitrification, bulk encapsulation or isolation, organic polymerization, dewatering, or thermoplastics.

4.4 REMEDIAL ACTION ALTERNATIVES

In Chapter 4 of the Feasibility Study, each of the technologies components are examined with respect to technical feasibility, public and environmental health, institutional issues, cost and effectiveness. One component alone would not be sufficient to provide the level of performance required to clean up the site. The preferred components were combined in various ways such that a range of levels of environmental protection as well as a range of associated costs are presented. Seven remedial action alternatives were developed based on the evaluation of the remedial action technological components. The alternatives are no action, on site containment, and waste removal. The alternatives with the estimated 1987 costs are summarized below:

Description	Estimated Cost
No Action	
o Continued groundwater monitoring	$ 308,000
On Site Containment	
o Earth cover with site grading	$ 1,360,000

- Earth cover with site grading and paving — $ 1,680,000
- Earth cover with site grading, paving, and groundwater pumping and treatment. — $ 3,610,000
- RCRA designed composite earth cover consisting of composite clay/geomembrane system and groundwater pumping and treatment. — Not estimated

Waste Removal

- Waste disposal in landfill and site grading — $ 12,500,000
- Waste disposal in landfill and site grading/paving — $ 13,000,000
- Waste disposal in landfill and site grading /paving, and groundwater pumping and treating. — $ 14,700,000

4.5 COMPARATIVE ANALYSIS OF CLEANUP ALTERNATIVES

The cleanup alternatives presented for the Alcoa site fall into three broad categories: 1) continued monitoring - no action, 2) on-site containment, and 3) source removal. Alcoa did not include waste reduction, minimization, or recycling criterion in the feasibility study because the criterion were not required until after the study was complete. The Department of Ecology requested that Alcoa consider storage and recycle of the potliner as a component of the cleanup alternative and construction of a RCRA cover as a component of the cleanup alternative in 1990 after the Feasibility Study was complete. Alcoa rejected the recycle component because of the current lack of a proven recycle cleanup technology and the potential of a land ban on the landfilling of potliner dangerous waste. The RCRA cover component was considered in one cleanup alternative scenario.

In addition to the criteria listed below, Alcoa examined the following cleanup alternative components: off-site incineration, fluid bed incineration, shallow slurry wall containment and deep slurry wall containment. Alcoa did not consider the two incineration treatment technologies because the processes are still in the experimental stages and require operational permits that are not in place. The costs of both technologies are significantly higher than the alternatives considered below. The deep and shallow slurry wall containment options were not considered as cleanup components because both technologies are marginal in cleanup effectiveness due to site specific characteristics and very costly. Each of the different cleanup alternatives considered for the site is discussed below with respect to its advantages and disadvantages. The Alcoa preferred alternative is source containment with earth cover, site grading and continued ground water monitoring. The Ecology preferred alternatives are (1) removal of potliner to a storage building and recycle, containment or removal to a dangerous waste landfill of contaminated soils, continued ground water monitoring and institutional controls on land and water usage or (2) waste disposal in a dangerous waste landfill, site grading, cover with geomembrane/soil containment system, institutional controls on land and ground water usage, and monitoring. During negotiations Ecology added a third source containment alternative consisting of construction of a RCRA composite clay/geomembrane cover over the waste piles, site grading, shallow slurry wall barrier, and a pump and treat ground water removal system.

4.5.1 No Action

Continued groundwater monitoring. This alternative involves no action other than continued monitoring and testing of existing monitoring wells. This alternative does not meet the goal of overall protection of human health and the environment or compliance with federal and state laws. No action - continued groundwater monitoring is not an acceptable cleanup alternative.

4.5.2 Source Containment on Site

Earth Cover with Site Grading. This alternative consists of covering the piles with an earth cap of clay and sand, grading and diverting surface water via lined ditches, culverts, and below-ground drains that flow to the aluminum plant water treatment system and Columbia River outfall. A portion of the existing rail road track will be moved south 30 feet and ground water monitoring would continue. This alternative prevents some infiltration through the waste piles and reduces infiltration around the waste piles. Water ponding around the site would be eliminated. The alternative is equivalent in risk to removal but at lower cost. The major disadvantage to the alternative is that the source of the contamination will always remain in place next to the Columbia River. The waste pile cover is not a composite cover and will have some leakage into the groundwater. No treatment of groundwater contamination is considered. The contaminated soils above the water table are not contained. This is the Alcoa preferred alternative.

Earth Cover with Site Grading and Paving. This remedial action alternative consists of constructing all of the items of the Earth Cover and Site Grading alternative with the addition of asphalt paving the area around the site. This alternative would greatly lower infiltration into the soils surrounding the piles. This would further reduce the loading into the Columbia River. The area could be used for storage of moderately heavy loads. Once again the source of the contamination would remain in place next to the Columbia River and ground water would not be treated.

Earth Cover with Site Grading, and Pumping and Treating Groundwater. In this alternative the waste piles would be covered with a clay/soil earth cover and the surrounding site would be graded to drain off-site via lined ditches, culverts, and below-ground pipes that flow into the aluminum plant water treatment system. Contaminated ground water would be withdrawn from the deep zone and treated. Sludges generated by treatment would be disposed of in a landfill. Treated water would be disposed of into the Columbia River.

Groundwater monitoring would continue. The major advantage of this alternative is that the loading of cyanide and fluoride from surface sources would decline due to reduced infiltration into the contaminated soils beneath the waste piles. The loading of fluoride and cyanide to the Columbia River from the treatment system would be greater than the current loading from the site because the treatment effluent has a greater concentration of cyanide and fluoride than the current groundwater flow from the site. The effectiveness of the pump and treat system is very limited since it does not pull contaminants from the highly contaminated intermediate zone. Residuals from the pump and treat system would have to be disposed of in a dangerous waste landfill. The costs for the operation of the pump and treat system are relatively high. The source of the contamination remains on site.

<u>RCRA Composite Clay/Geomembrane Cover, Site Grading, Shallow Slurry Wall Barrier, and Pump and Treat.</u> This remedial action alternative was considered by Alcoa after the Feasibility Study was complete. The alternative consists of a composite clay/geomembrane cover with site grading and surface water diversion via lined ditches, culverts, and below-ground pipes. The contaminated shallow zone beneath the waste piles would be contained using a slurry wall. Contaminated ground water would be pumped from the deep zone and treated. Treated water would be disposed in the Columbia River. Groundwater monitoring would continue. The advantages of this alternative are similiar to the earth cover alternative advantages. The RCRA cover technology assures that precipitation will not enter the waste piles. The addition of a shallow slurry wall will prevent groundwater accumulation in the contaminated dredged sands beneath the piles and reduce the amount of leachate generated by infiltration through the silt layer. The major disadvantage of this alternative is that the source of the contamination remains on site and dangerous wastes are generated by the pump and treat facility. The loading of cyanide and fluoride in the Columbia River would increase over the short term. Costs to implement this remedial action are high.

4.5.3 Source Removal

<u>Waste Disposal in Landfill and Grade Site.</u> Waste piles would be excavated and taken to a dangerous waste landfill. The site would be graded and surface water would be removed from the site via lined ditches, culverts, and below ground drains. Surface water would be diverted to the plant treatment system and the Columbia River outfall. The removal of the source material lowers the risk of additional leachate being generated. Ground water monitoring would continue. There is still potential of leachate generation from the vadose zone soils found beneath the piles. The cost of removal is significantly higher than the cover options.

<u>Waste Disposal in Landfill with Site Grading and Paving.</u> Waste piles would be excavated and taken to a dangerous waste landfill. The site and adjacent roads would be graded and paved with asphalt. Drainage on site would be diverted to

the plant Columbia River outfall. Ground water monitoring would continue. The source of the contamination would be removed. The threat of further contamination of the ground water would be limited by reducing infiltration of precipitation through the site. The major disadvantage is high costs.

Waste Disposal in Landfill with Site Grading and Pumping and Treating Groundwater. The waste material would be excavated and removed to a dangerous waste landfill. The site would be graded and surface water would be diverted off-site via lined ditches, culverts, and below ground-drains into the aluminum plant waste water treatment system. Contaminated groundwater would be pumped from wells installed to 80 feet, the top of the deep zone, and treated to remove cyanide and fluoride. Sludge from the treatment system would be disposed in a regulated landfill. Treated water would be disposed into the Columbia River. Groundwater monitoring would continue. The major advantage of the cleanup scenario is that the source material would be removed from the site and the movement of contaminants into the Columbia River would decrease from the site but increase from the treatment plant. The major disadvantages are cost and effectiveness. The treatment plant effluent loading of the Columbia River would be greater than the current groundwater loadings from the site. The site would be cleaned up faster, but the river would have higher contaminant loadings unless the treated water was diluted prior to entering the river.

SELECTION OF CLEANUP ALTERNATIVE

5.1 INTRODUCTION

The cleanup strategy proposed by Ecology is to combine source removal, institutional controls, and containment of contamination to provide for the protection of human health and the environment. This strategy assumes that the area around the site will be used for industrial or commercial purposes for the foreseeable future. Ecology combined portions of several of the cleanup alternatives to propose three preferred cleanup alternatives for the site. These alternatives are: 1) removal of the potliner to a storage building and recycle, containment or removal of contaminated soils below the waste piles, and institutional controls on site land and groundwater usage, 2) potliner waste disposal in a dangerous waste landfill, site grading, construction of a geomembrane/soil containment system, institutional controls on land and groundwater usage, and monitoring, and 3) covering of potliner piles with a RCRA composite clay/geomembrane cover, site grading, shallow slurry wall barrier, and a pump and treat groundwater removal system. The proposed cleanup alternative that was selected is described in more detail below.

5.2 SELECTED CLEANUP ACTION

The proposed cleanup action consists of waste disposal in a landfill, site grading and covering with an HDPE or PVC liner, and continued groundwater monitoring. Specifically:

-- Removal of approximately 66,000 tons (47,500 cubic yards) of spent potlining and reclaimed alumina insulation.

-- Characterization of soils below existing potlining piles.

-- Capping with a 50 mil HDPE or 40 mil PVC liner and covering with two feet of clean sand with top soil. Revegetating area.

-- Fence and grade site to drain.

-- Institutional controls to prevent the disruption of the liner or withdrawal of groundwater from the contaminated plume.

-- Continued groundwater and Columbia River surface water monitoring.

In addition to the major cleanup action tasks the following actions will be taken at the site during and after cleanup:

-- Air monitoring for dust, cyanide and ammonia will occur during the remediation.

-- Site access will be limited. Worker health and safety programs will protect cleanup workers from potliner and ammonia.

-- Ground water remediation will be required if fluoride and cyanide concentrations increase near the Columbia River. The concentration of cyanide and fluoride will have to increase to levels that are treatable.

A detailed description of each of the components of the cleanup action is given below.

5.3 SOURCE CONTROL

Source control would consist of removal of the potliner material to a permitted hazardous waste facility. At the present time the hazardous waste facility at Arlington, Oregon is being considered for the project. The removal of the 66,000 tons of material is to be accomplished using conventional excavation equipment.

Front end loader and backhoe will be used to remove and stockpile the existing clean sand cover. The clean sand will be stockpiled and used as the sand cover above the geomembrane cover. The existing 12 mil plastic cover will be removed and disposed of at the dangerous waste facility. Due to the large quantity of waste, approximately 20 to 30 trucks a day will be required to move the waste to the Arlington, Oregon facility. This phase of the project will take approximately three to five months to complete.

The contaminated soils beneath the piles will be characterized for cyanide and fluoride once the potliner is removed. No chemical data is currently available from directly beneath the potliner piles. Each pile will be divided into quarters and one drill hole will be randomly selected in each quarter. The drill hole will be completed through the shallow zone into the intermediate zone. Two composited samples will be taken from each drill hole. The top five feet and bottom 5 to 8 feet. The samples will be analyzed for cyanide and fluoride.

Alcoa will present to Ecology for approval, prior to the start of the source removal, a site health and safety plan in accordance with most recent OSHA, WISHA, Department of Ecology, and EPA guidance and applicable regulations.

5.4 CONTAINMENT

After the potliner is removed from the site, the pile areas will be covered with either HDPE or PVC liner and clean fill; or a recompacted two foot clay liner and clean fill. Alcoa has indicated it would prefer a geomembrane liner. The geomembrane will prevent the possibility of uncontrolled contact with the contaminated soil and water infiltration into the contaminated soil column. Conventional equipment will be used to place the liner and soil cover. A portion of the sand for the cover will come from the stockpiled cover material. After placement of the geomembrane, soils and top soil; the area will be hydroseeded.

Alcoa will inspect and perform maintenance on the final cap quarterly during the regularly scheduled ground water monitoring activities. Maintenance requirements for the final cap shall include grading to maintain proper site drainage, repair of any erosion or areas of distressed vegetation, and repair of site perimeter fencing and warning signs.

5.5 GROUNDWATER AND SURFACE WATER MONITORING

Since contaminated soils will remain on site, a conformational monitoring program for cyanide and fluoride will be implemented as part of the cleanup. The proposed groundwater monitoring plan consists quarterly monitoring for five years with analysis of cyanide and fluoride. Twenty three monitoring wells will be analyzed. At the end of the five year period Ecology and Alcoa will exchange proposals to amend the consent decree with regard to whether continue groundwater monitoring is necessary and, if so, what constitutes an appropriate schedule. The proposed monitoring program will be evaluated and the end of each five year period until the site is no longer a danger to human health and the environment.

Alcoa will also preform surface water analysis of the Columbia River at the site and up stream of the site. This analysis will collect samples quarterly for two years and then annually if cyanide and fluoride are below the cleanup standards. The surface water program is proposed to run for five years.

5.6 INSTITUTIONAL CONTROLS

Alcoa will record a restrictive land use covenant in the property deed of the site to ensure that no ground water is removed for domestic purposes from the contained plume and that there is no interference with the cleanup action. This covenant will be specified in the Consent Decree. Alcoa, may use the site for industrial purposes consistent with the cleanup action and the covenant. When levels of fluoride in ground water reach 4 mg/l and free cyanide in ground water reach 0.2 mg/l Alcoa or an owner of th esite after Alcoa, may request that the restrictive covenant be removed. Ecology, or a successor agency, may consent to the request only after public notice and comment and only insofar as the request is consistent with applicable law, including cleanup standards for soils.

5.7 SCHEDULE

The proposed cleanup is scheduled to occur in 1992. If approved, the initial potliner removal and installation of the soil/geomembrane cap will occur in the spring and summer of 1992. It is anticipated that the construction portion of the project will be complete by the fall of 1992. Final as built construction diagrams, project completion report, and monitoring plans will be delivered to Ecology after the 1992 construction season. Surface water, groundwater and maintenance monitoring will begin in 1993 and continue for five years. At the end of the five year period Ecology and Alcoa will exchange proposals for continued monitoring.

APPENDIX A

Administrative Record

The contamination at the site was brought to the attention of Ecology in 1981. Prior to this Alcoa began ground water and soil investigations to determine the extent of contamination. The following studies document activities that were conducted from 1977 to the present to determine the extent and magnitude of contamination at the present potliner NPL site. This list of documents represents the Administrative Record for the Alcoa Vancouver NPL Site.

1. Department of Ecology, Industrial Section, Aluminum Company of America Vancouver Operations Files 1978 through 1992.

2. Robinson and Noble, Inc., 1979, Investigation of Possible Groundwater Contamination for Alcoa, Vancouver.

3. Robinson Noble and Carr, Inc., 1981, Interim Report on Potential Contamination of Shallow Groundwater at Aluminum Company of America.

4. Robinson and Noble, Inc., 1982, Cyanide Contamination Study of Aluminum Company of America at Vancouver, Washington.

5. Nord, T. L. and Potter, R., 1982, The Generation of Spent Potlings by the Primary Aluminum Industry December 1982, Department of Ecology Files , Olympia, WA.

6. Nord, T. L., 1983, The Designation of Spent Potlinings, Chapter 173-303 WAC, December 1983, Department of Ecology Files, Olympia, WA.

7. Nord, T. L., 1984, The Designation of Spent Potlinings, Chapter 173-303 WAC, February 1984, Department of Ecology Files, Olympia, WA.

8. Robinson and Noble, Inc., 1984, Investigation of Contamination at Vancouver Plant, Phase 1, September 1984.

9. Environmental Protection Agency, 1985, HRS Hazard Ranking System Score Sheet and Documentation for the Aluminum Company of America Vancouver Operations, B. Morson, P. O'Flaherty, L. Stralin.

10. Hart Crowser, Inc., 1986, Preliminary Assessment of Groundwater Quality Conditions, Aluminum Company of America, Report J-1759, Vancouver Operations, Washington.

11. Department of Ecology, Industrial Section, 1986, Order DE 86-419 issued to Aluminum Company of America Vancouver Operations.

12. Hart Crowser, Inc., 1987, Remedial Investigation, Aluminum Company of America, Report J-1759-02, Vancouver Operations, Vancouver, WA.

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18. E. V. S. Consultants, 1989, Acute Toxicity Tests on Spent Potlining Samples, November, December Test Results, Seattle, WA.

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21. Pierre Gy and Francis Pitard Sampling Consultants, 1989, Sampling Plan for the Analysis of Certain Metals, Compounds, and Other Properties of Spent Potlining and Reclaimed Alumina Insulation at the Alcoa Vancouver, Washington Site.

22. Hart Crowser, Inc., 1990, Remedial Investigation Plan, Former Alcoa Facility, Report J-2250-03, Vancouver, Washington.

23. Schmidt, K. D., 1990, Vancouver Spent Potlining Results, Report Number 70-90-05, Environmental Control Laboratory , Aluminum Company of America, Alcoa Technical Center, Alcoa Center, PA.

24. E. V. S. Consultants, 1990, Acute Toxicity Tests on Spent Potlining Samples, January Test Results, Seattle, WA.

25. Blayden, L. C., 1990, Waste Pile Characterization, Vancouver, Washington Site, Alcoa Environmental Laboratory Report No. 70-90-11, Aluminum Company of America, Alcoa Center, PA.

26. Agency for Toxics Substances and Disease Registry, U. S. Public Health Service, 1990, Health Assessment for Alcoa (Vancouver Smelter), Vancouver, Clark County, Washington.

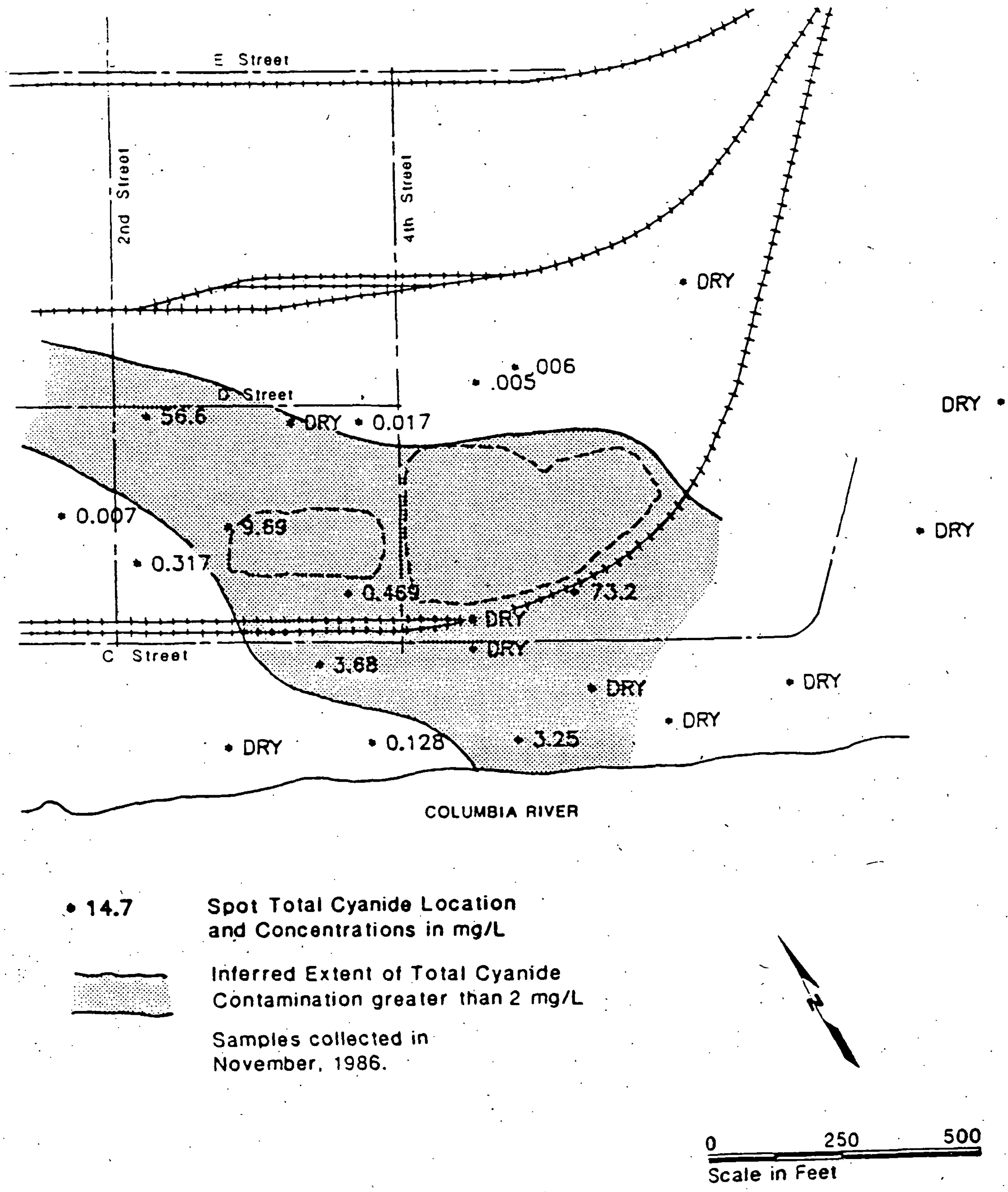
The contaminates of concern at the Alcoa-Vancouver site are cyanide and fluoride. The above investigations document the extent and concentration of the cyanide and fluoride contamination found at the site.

APPENDIX B.

Ground Water and Soil Geochemical Data

Total Cyanide Concentration Map

Concentrations in Groundwater from Shallow Zone



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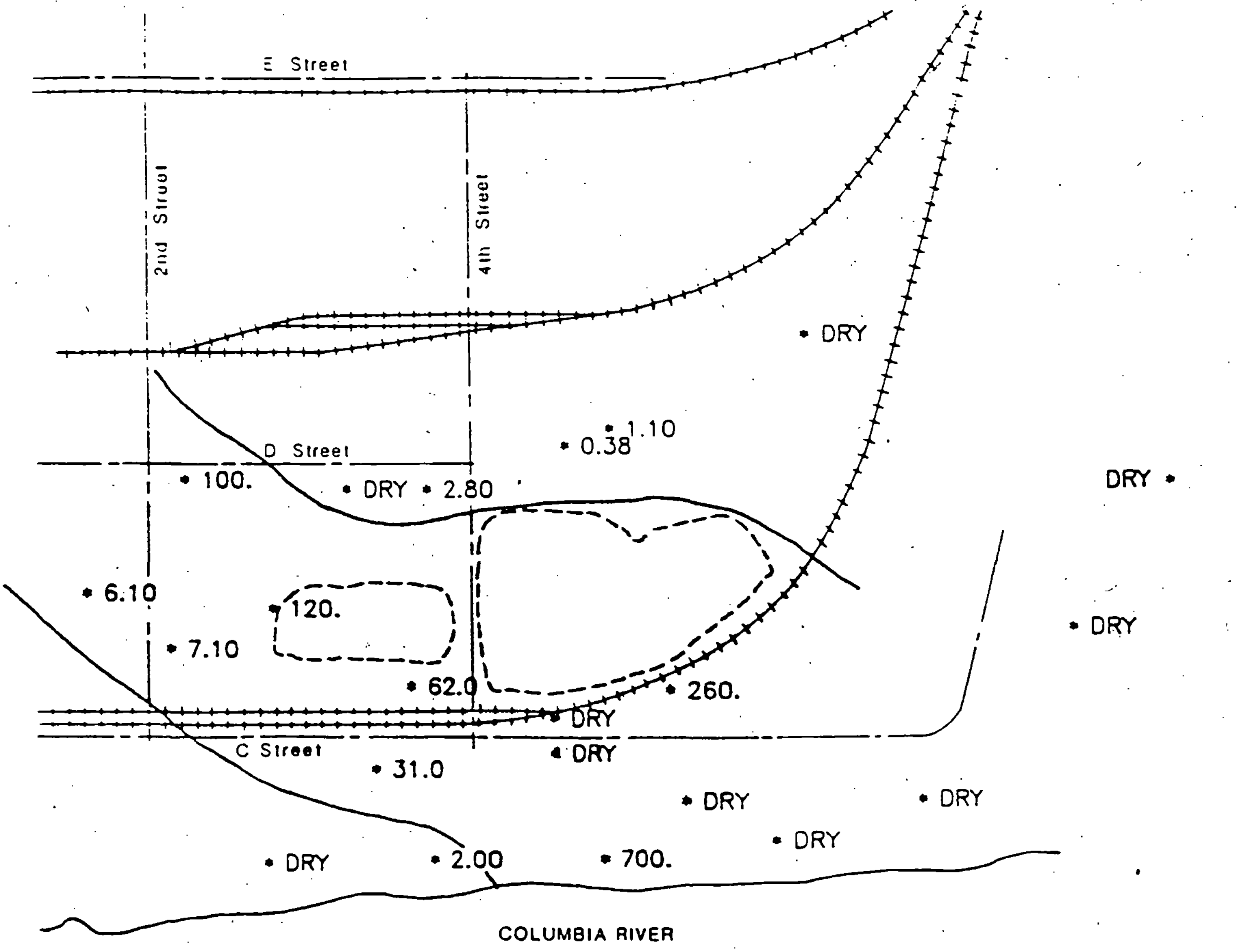
Fluoride Concentration Map

Concentrations in Groundwater from Shallow Zone



• 7.52 Spot Fluoride Location and Concentrations in mg/L

Inferred Extent of Fluoride Contamination greater than 5 mg/L

Samples collected in November, 1986.

N

0 250 500

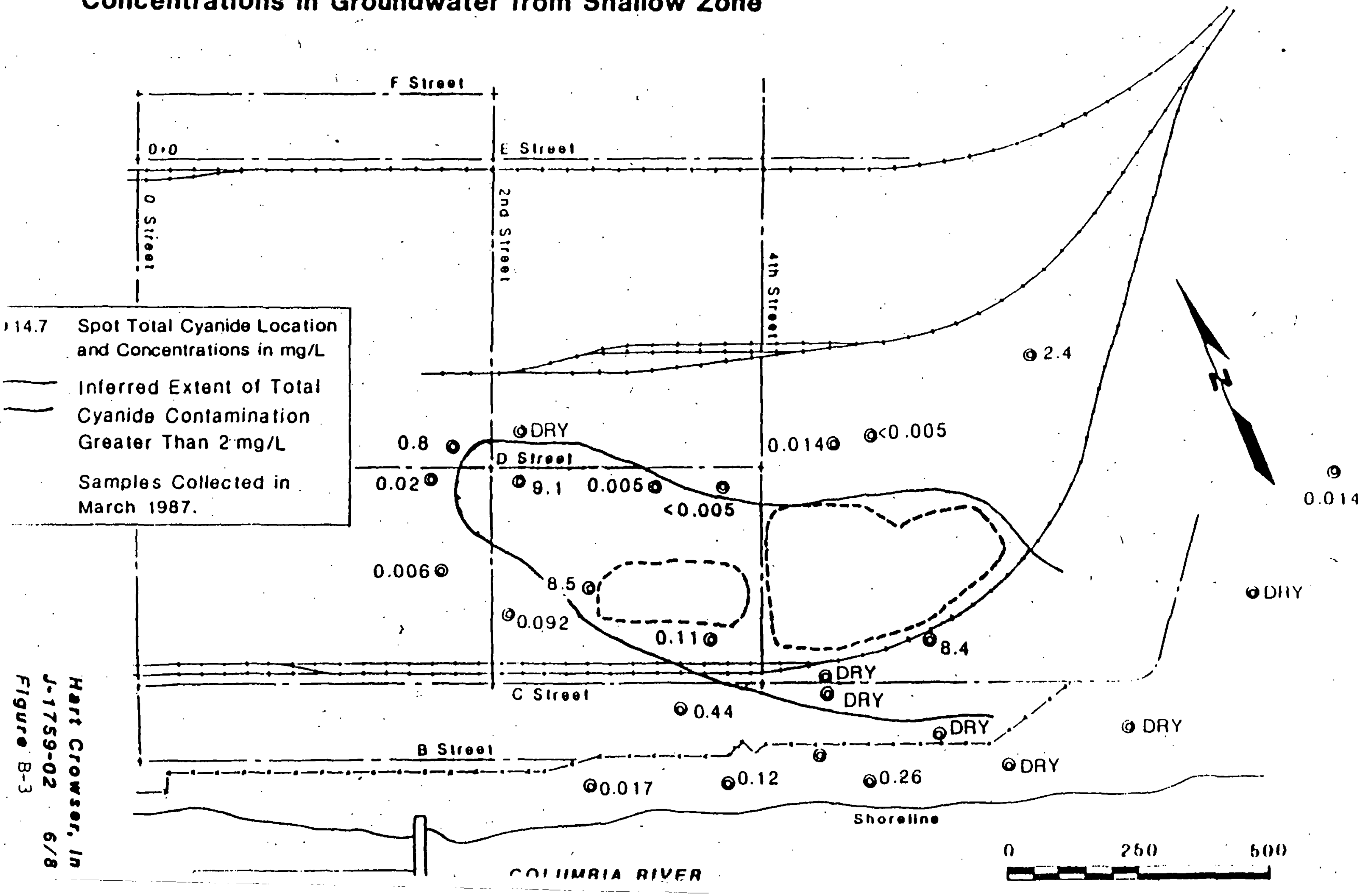
Scale in Feet

J-1759-02 June 1987

HART-CROWSER & associates inc.

Total Cyanide Concentration Map

Concentrations in Groundwater from Shallow Zone



Hart Crowser, In
J-1759-02 6/8
Figure B-3

Fluoride Concentration Map

Concentrations in Groundwater from Shallow Zone

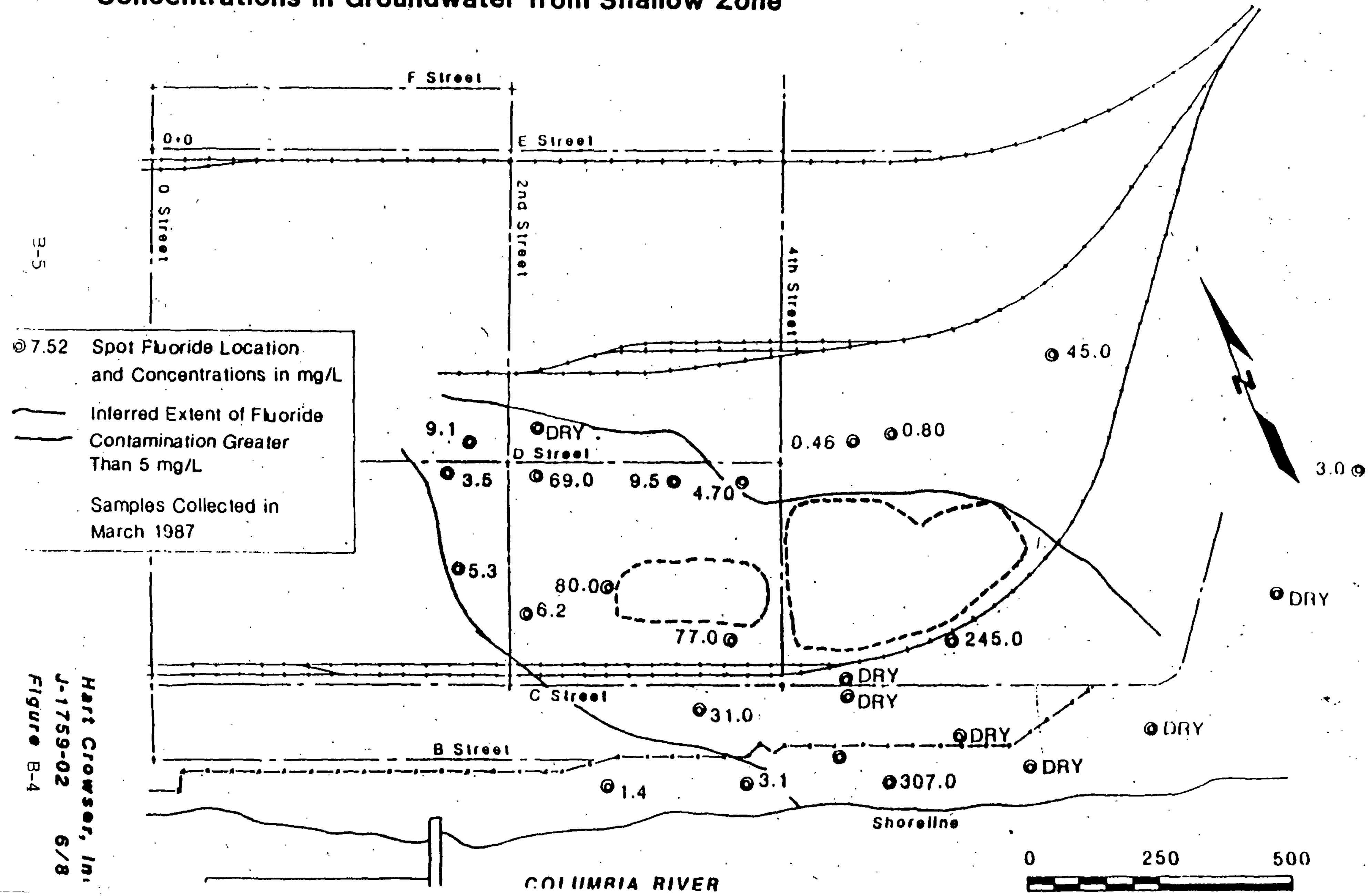


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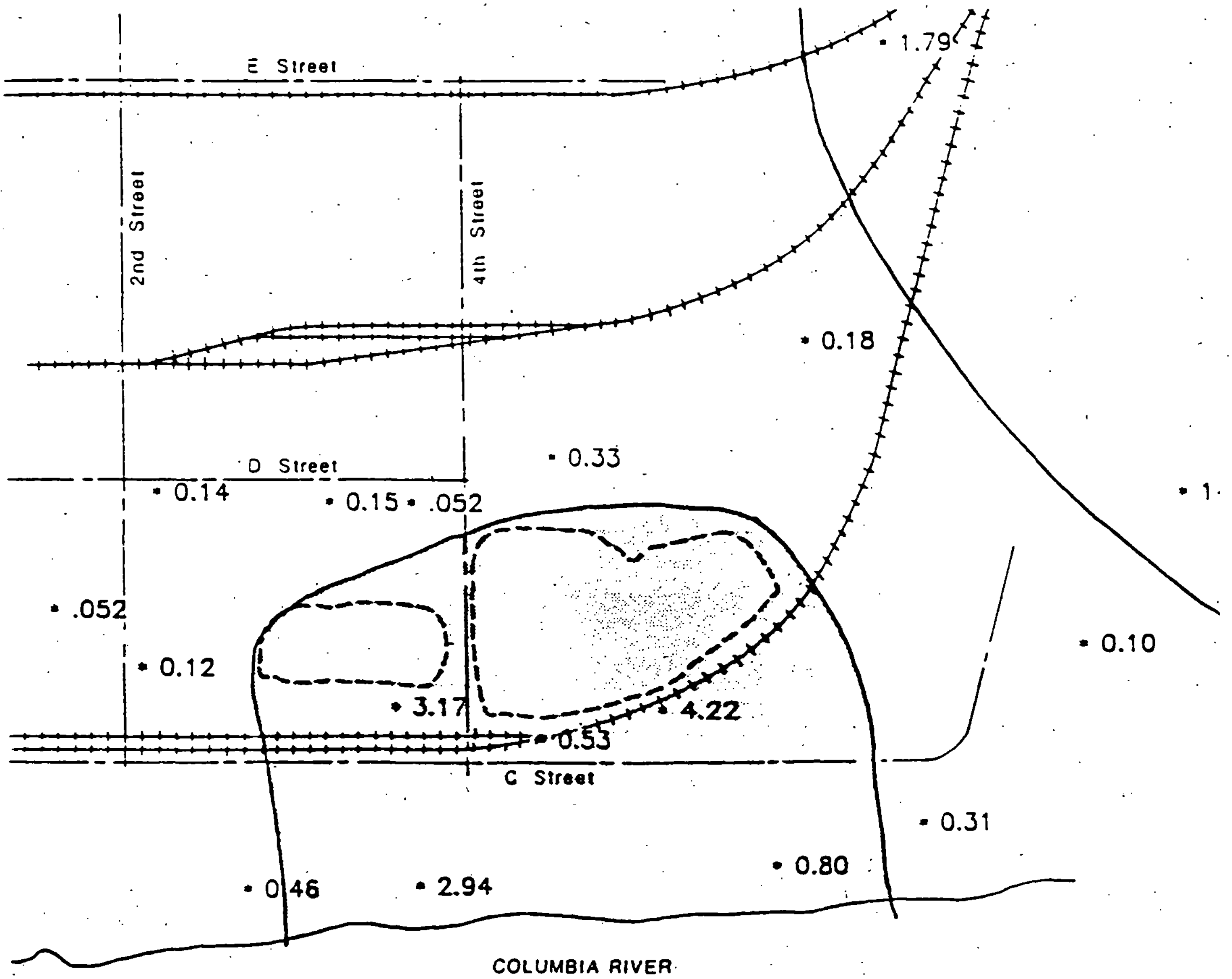
Figure B-4

Total Cyanide Concentration Map

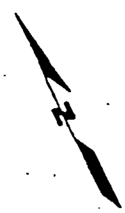
Average Concentrations in Soil Samples from Shallow Zone



• .7.0 Spot Average Total Cyanide Location and Concentrations in mg/kg

——— Inferred Extent of Total Cyanide Contamination greater than .5 mg/kg

Samples collected in August and September, 1986.



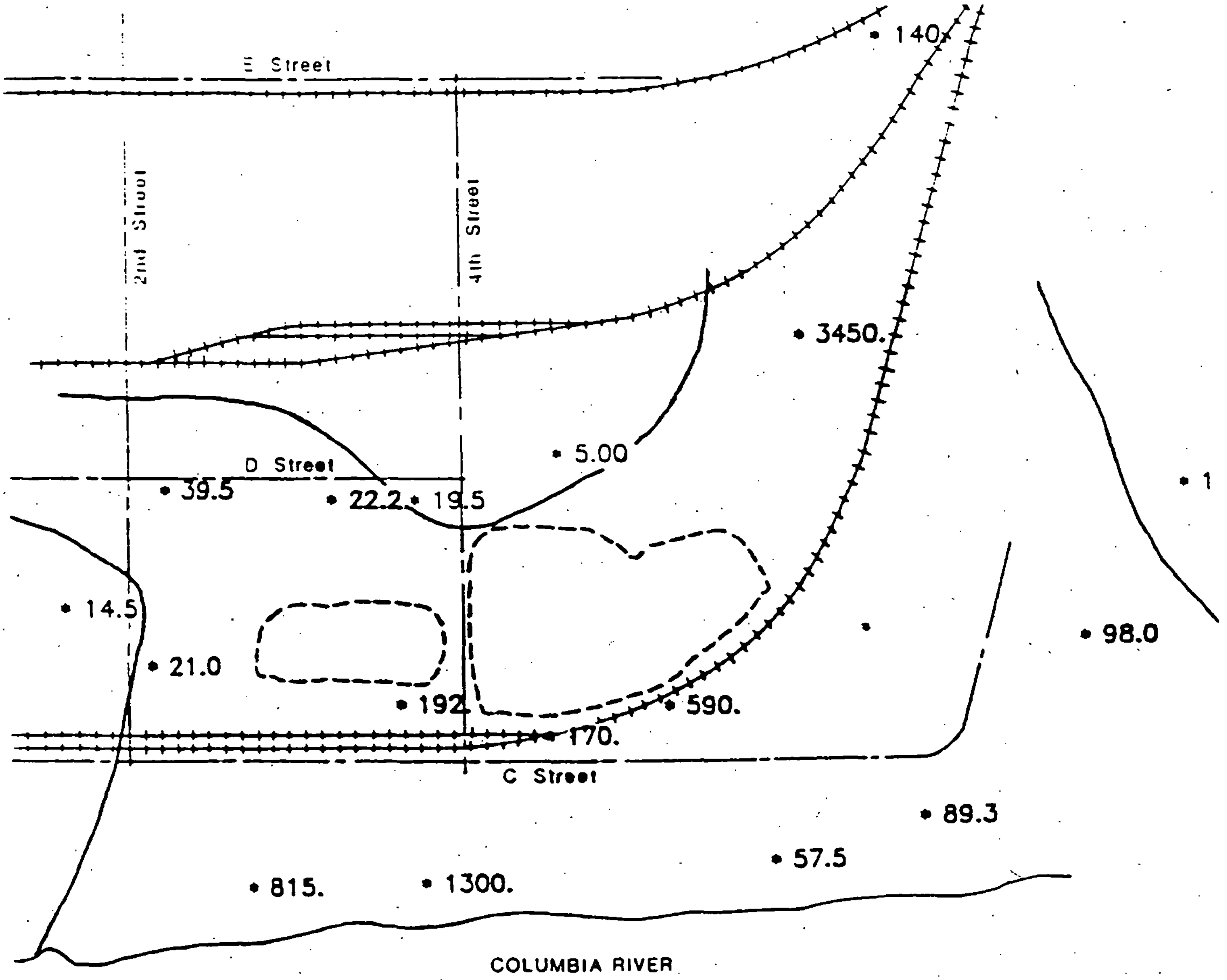
0 250 500
Scale in Feet

J-1759-02 June 198

HART-CROWSER & associates in

Fluoride Concentration Map

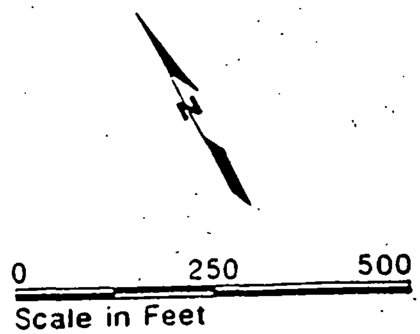
Average Concentrations in Soil Samples from Shallow Zone



• 8.43 Spot Average Fluoride Location and Concentrations in mg/kg

Inferred Extent of Fluoride Contamination greater than 20 mg/kg

Samples collected in August and September, 1986.



J-1759-02 June 198

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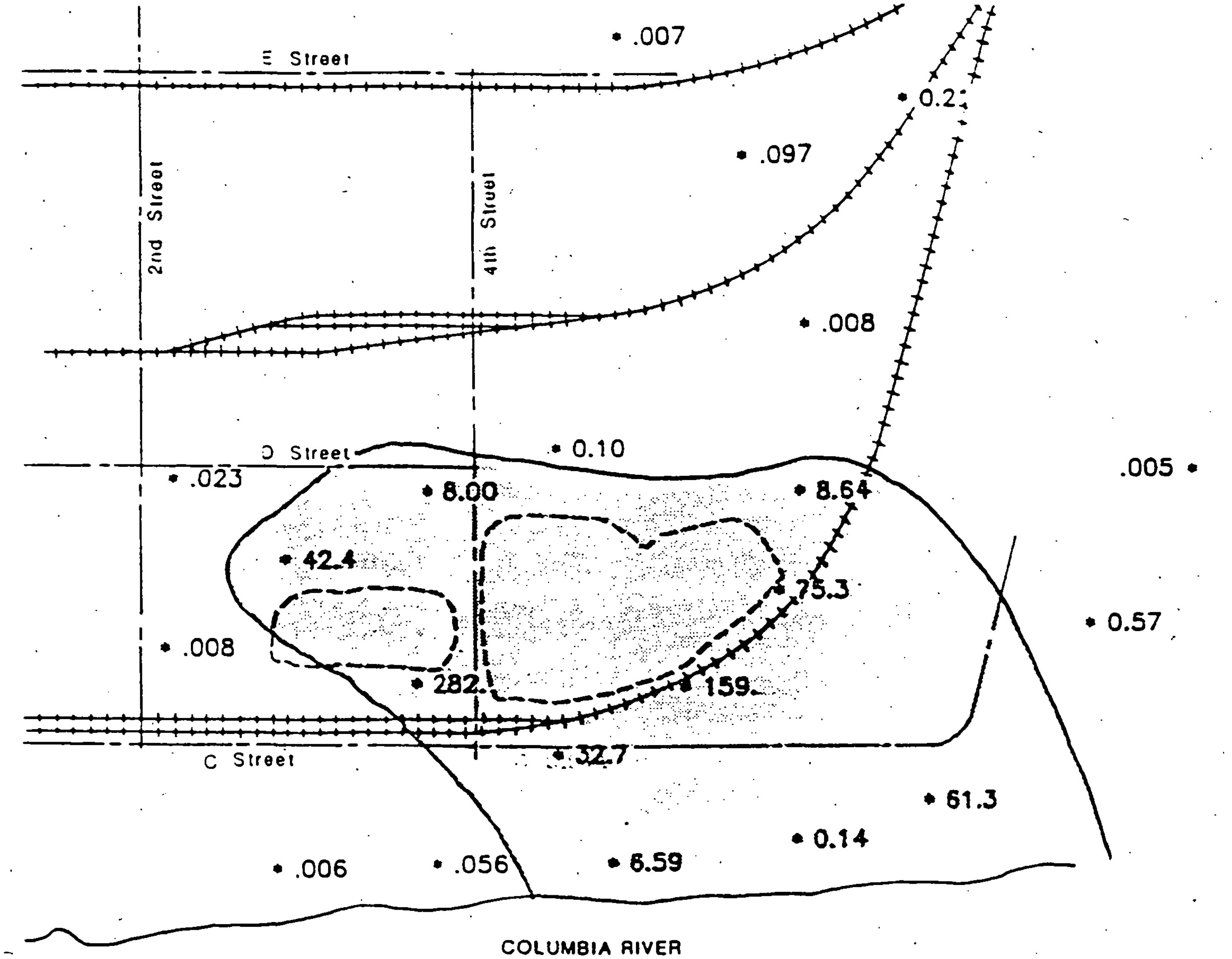
Figure B-6

Total Cyanide Concentration Map

Concentrations in Groundwater from Intermediate Zone



• 14.7 Spot Total Cyanide Location and Concentrations in mg/L

Inferred Extent of Total Cyanide Contamination greater than 2 mg/L

Samples collected in November, 1986.

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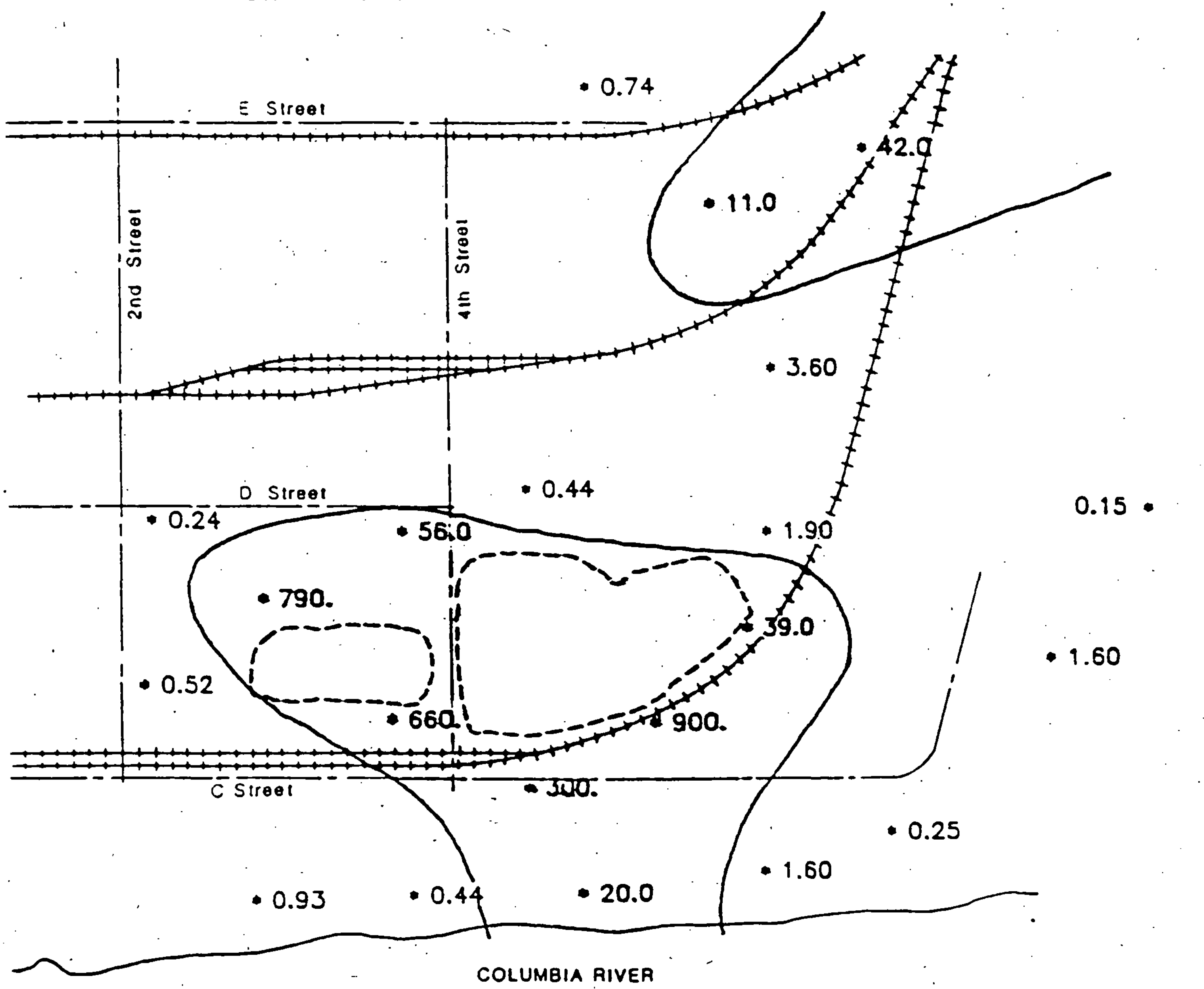
Figure B-7

Fluoride Concentration Map

Concentrations in Groundwater from Intermediate Zone



• 7.52 — Spot Fluoride Location and Concentrations in mg/L

Inferred Extent of Fluoride Contamination greater than 5 mg/L

Samples collected in November, 1986.

J-1759-02 June 1987

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Total Cyanide Concentration Map

Concentrations in Groundwater from Intermediate Zone

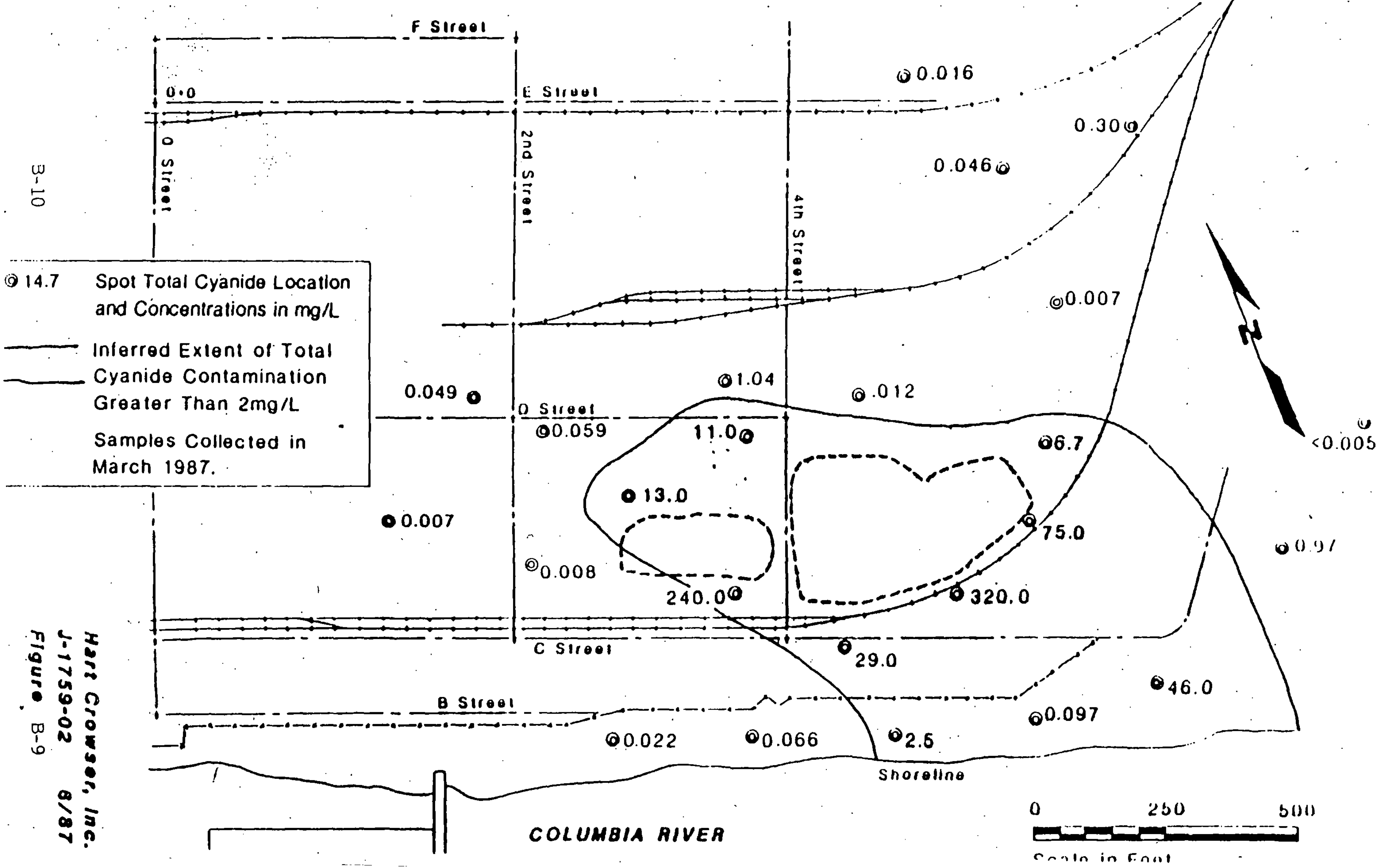

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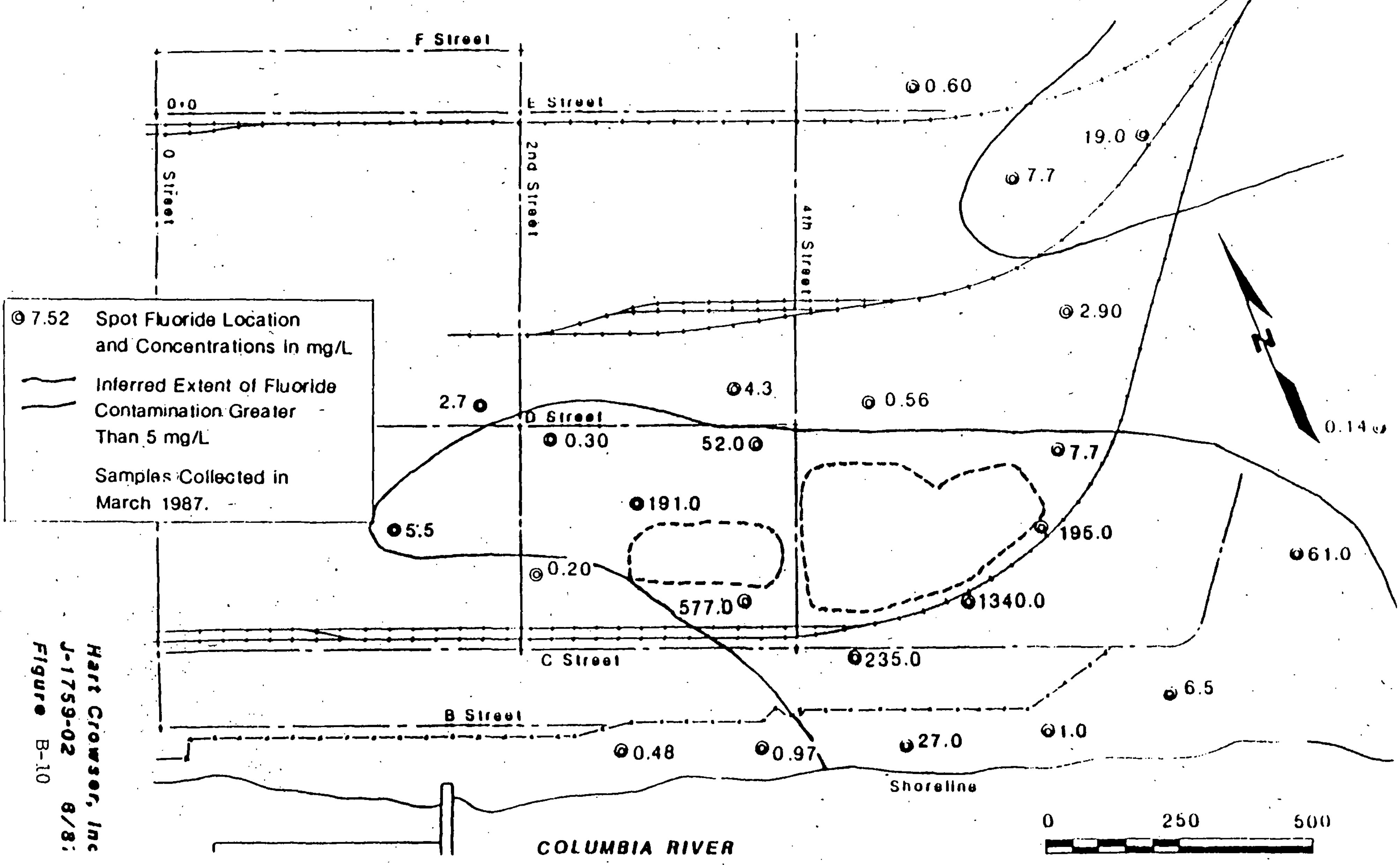
Figure B-9

Fluoride Concentration Map

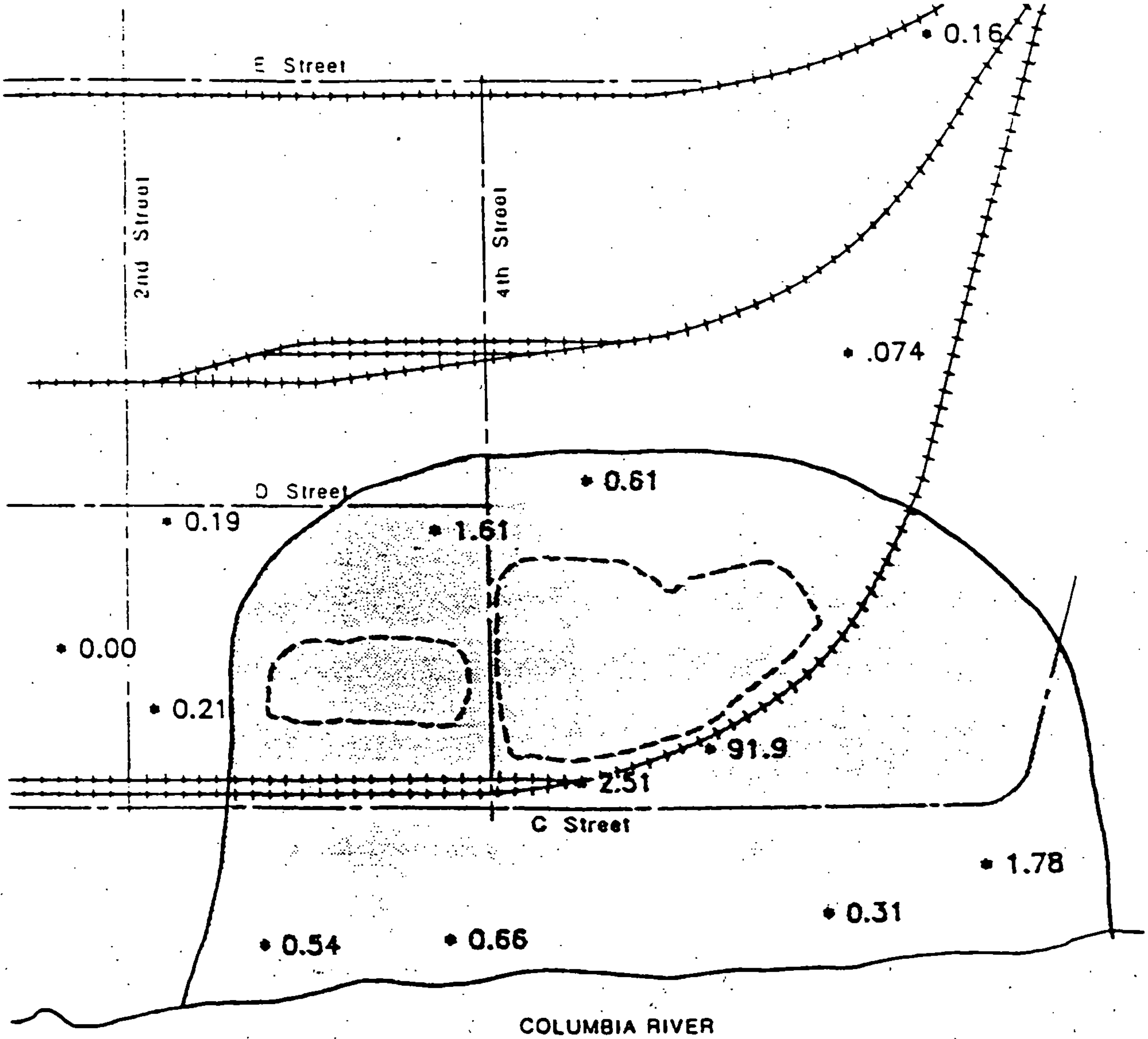
Concentrations in Groundwater from Intermediate Zone



Hart Crowser, Inc
J-1759-02 8/87
Figure B-10

Total Cyanide Concentration Map

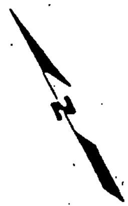
Average Concentrations in Soil Samples from Intermediate Zone

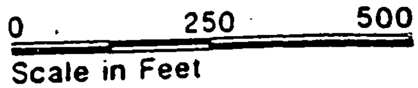


• .07 Spot Average Total Cyanide Location and Concentrations in mg/kg

Inferred Extent of Total Cyanide Contamination greater than 0.5 mg/kg

Samples collected in August and September, 1986.





J-1759-02 June 1

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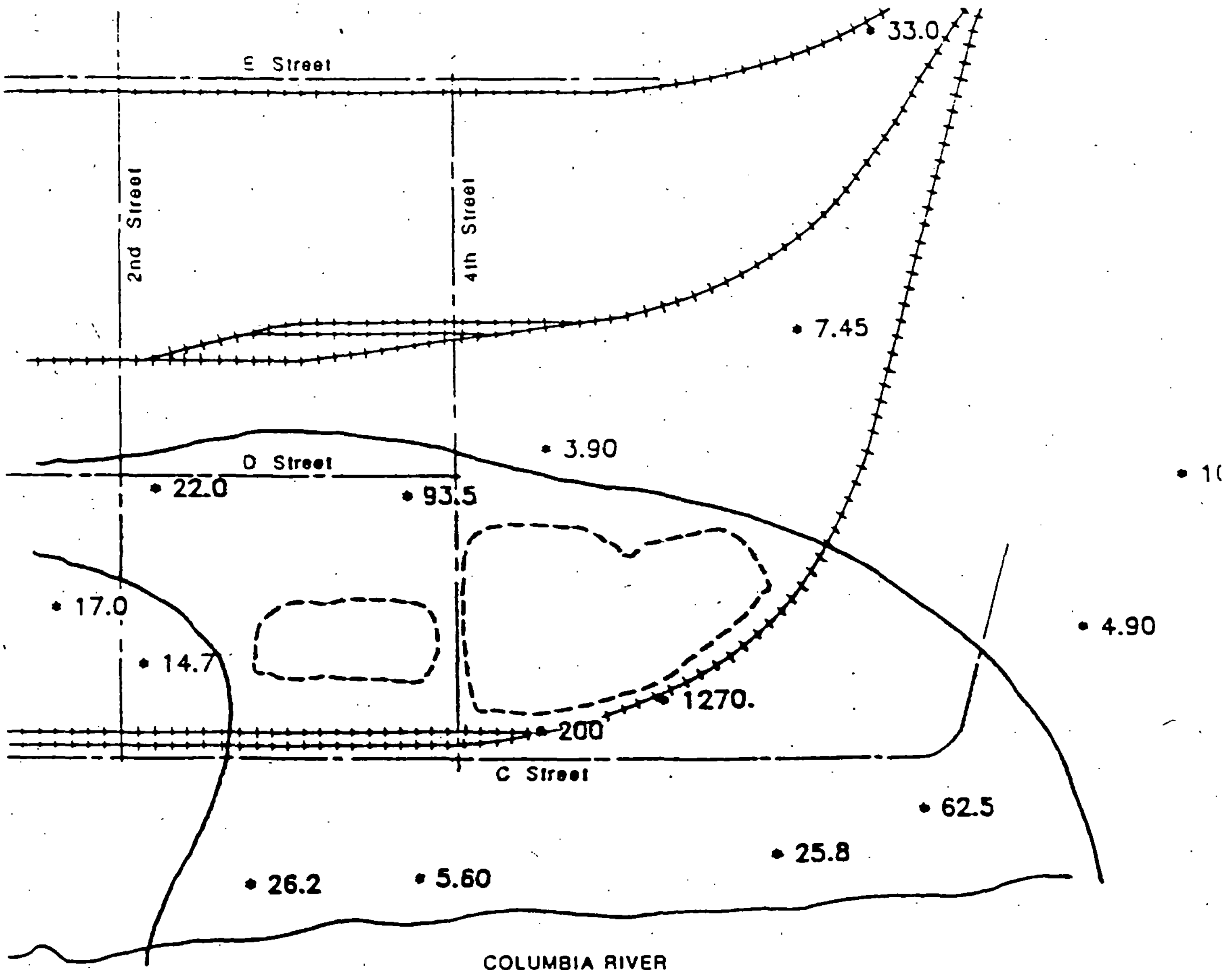
Figure B-1

Fluoride Concentration Map

Average Concentrations in Soil Samples from Intermediate Zone



• 8.43 Spot Average Fluoride Location and Concentrations in mg/kg

Inferred Extent of Fluoride Contamination greater than 20 mg/kg

Samples collected in August and September, 1986.

0 250 500
Scale in Feet

J-1759-02 June 198

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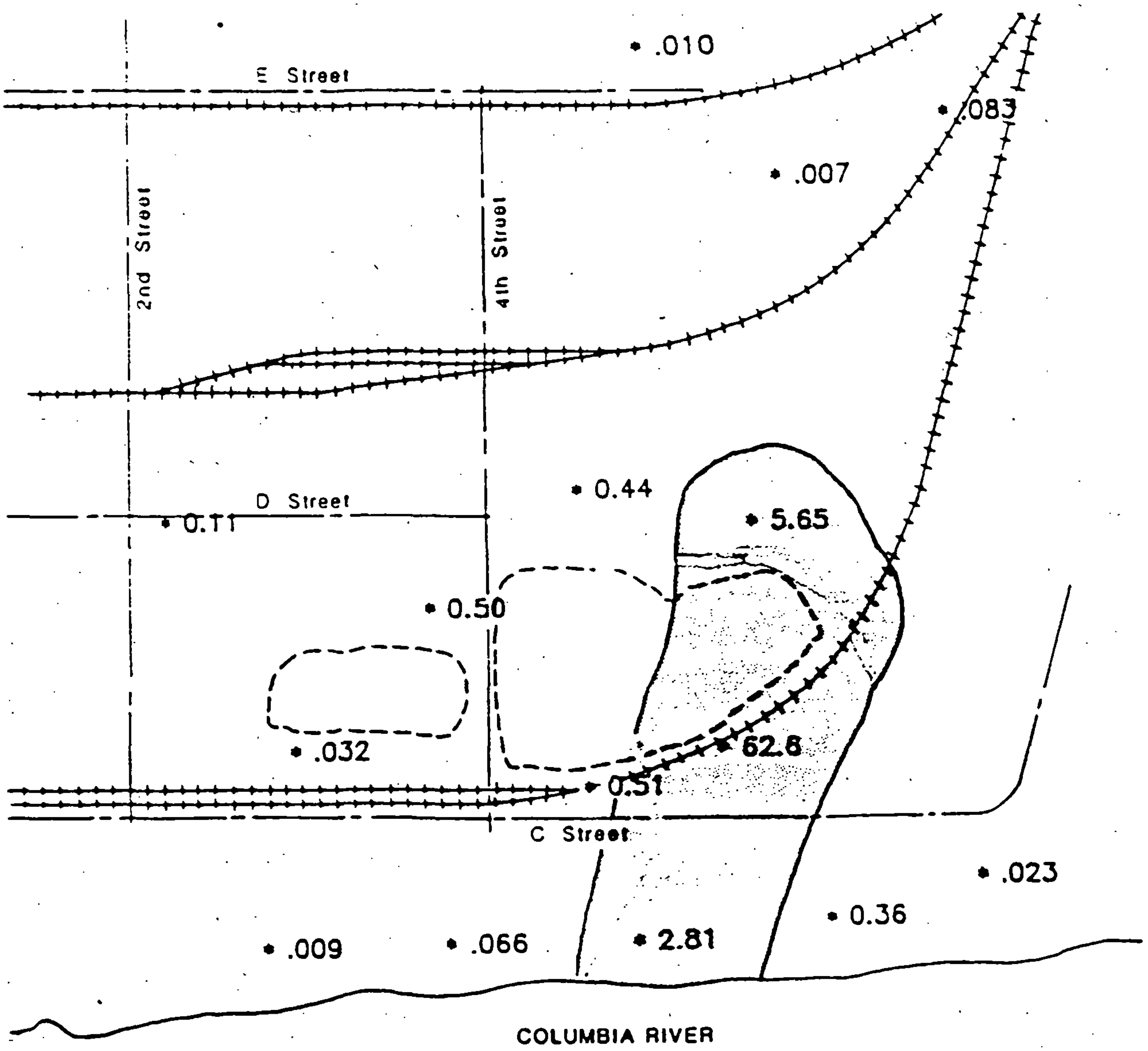
Total Cyanide Concentration Map

Concentrations in Groundwater from Deep Zone



• 4.7 Spot Total Cyanide Location and Concentrations in mg/L

Inferred Extent of Total Cyanide Contamination greater than 2 mg/L

Samples collected in November, 1986.

0 250 500

Scale in Feet

J-1759-02 June 19

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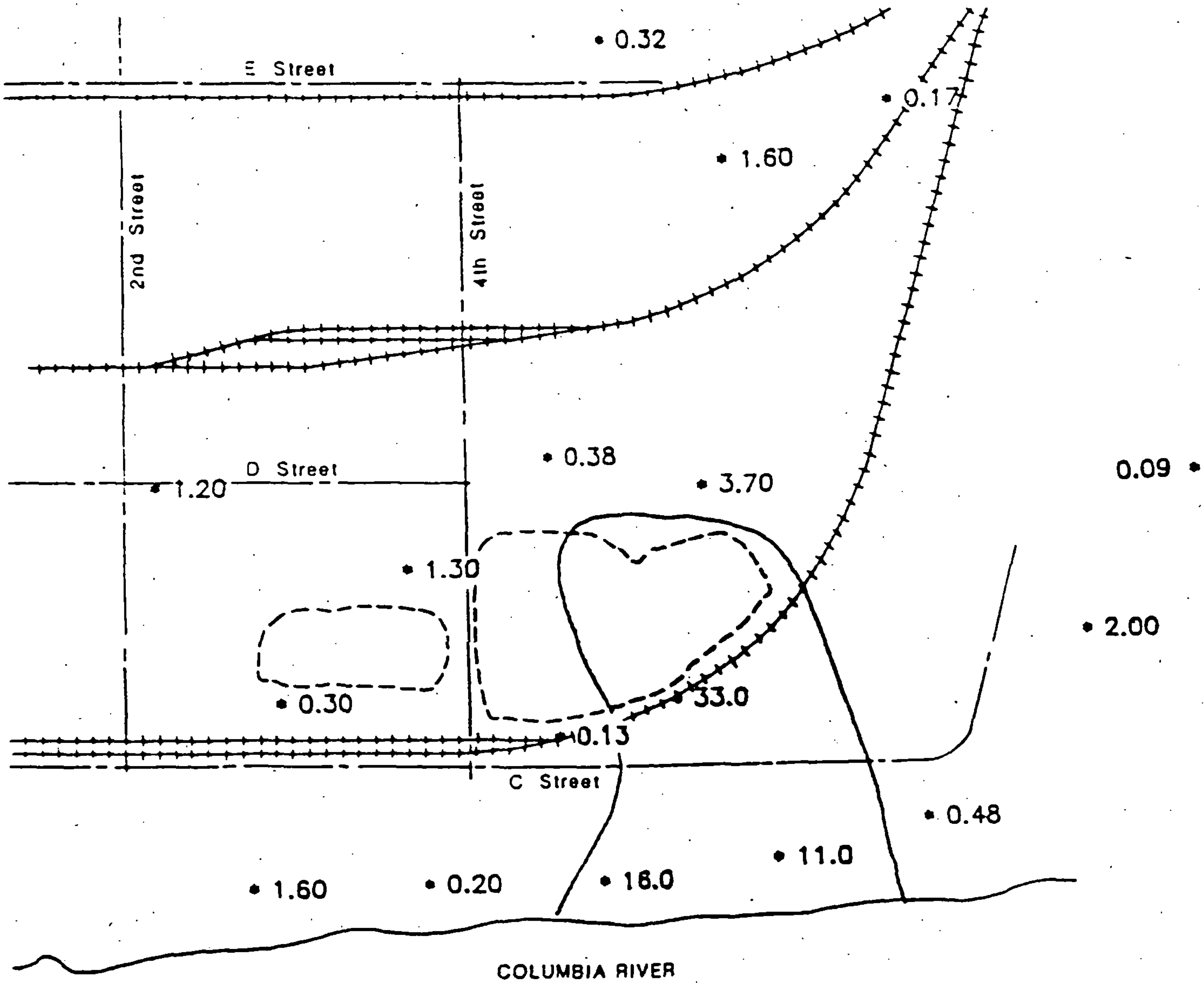
Figure B-13

Fluoride Concentration Map

Concentrations in Groundwater from Deep Zone



• 7.52 Spot Fluoride Location and Concentrations in mg/L

Inferred Extent of Fluoride Contamination greater than 5 mg/L

Samples collected in November, 1986.

N

0 250 500
Scale in Feet

J-1759-02 June 19

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Figure B-14

Total Cyanide Concentration Map

Concentrations in Groundwater from Deep Zone

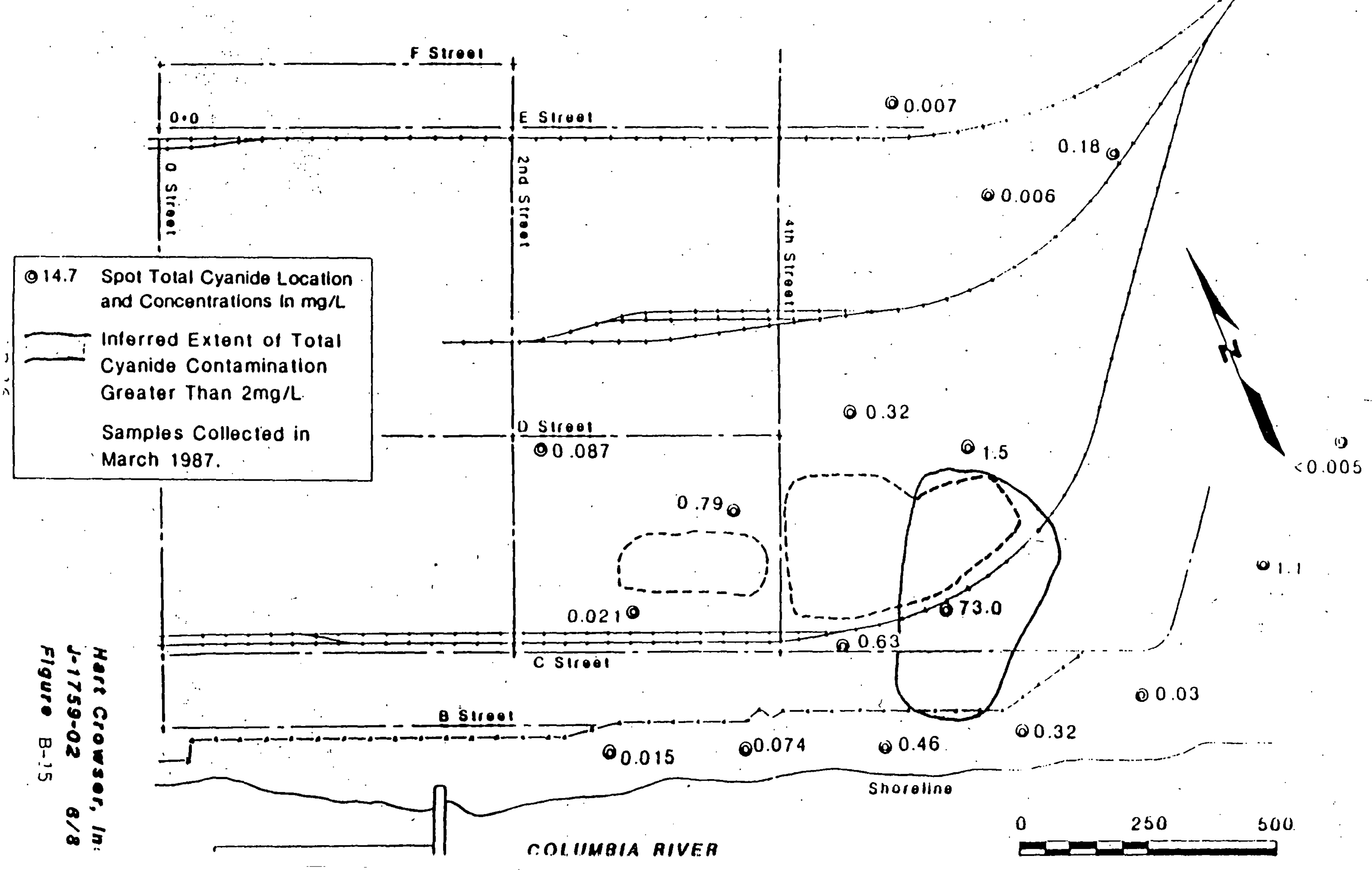

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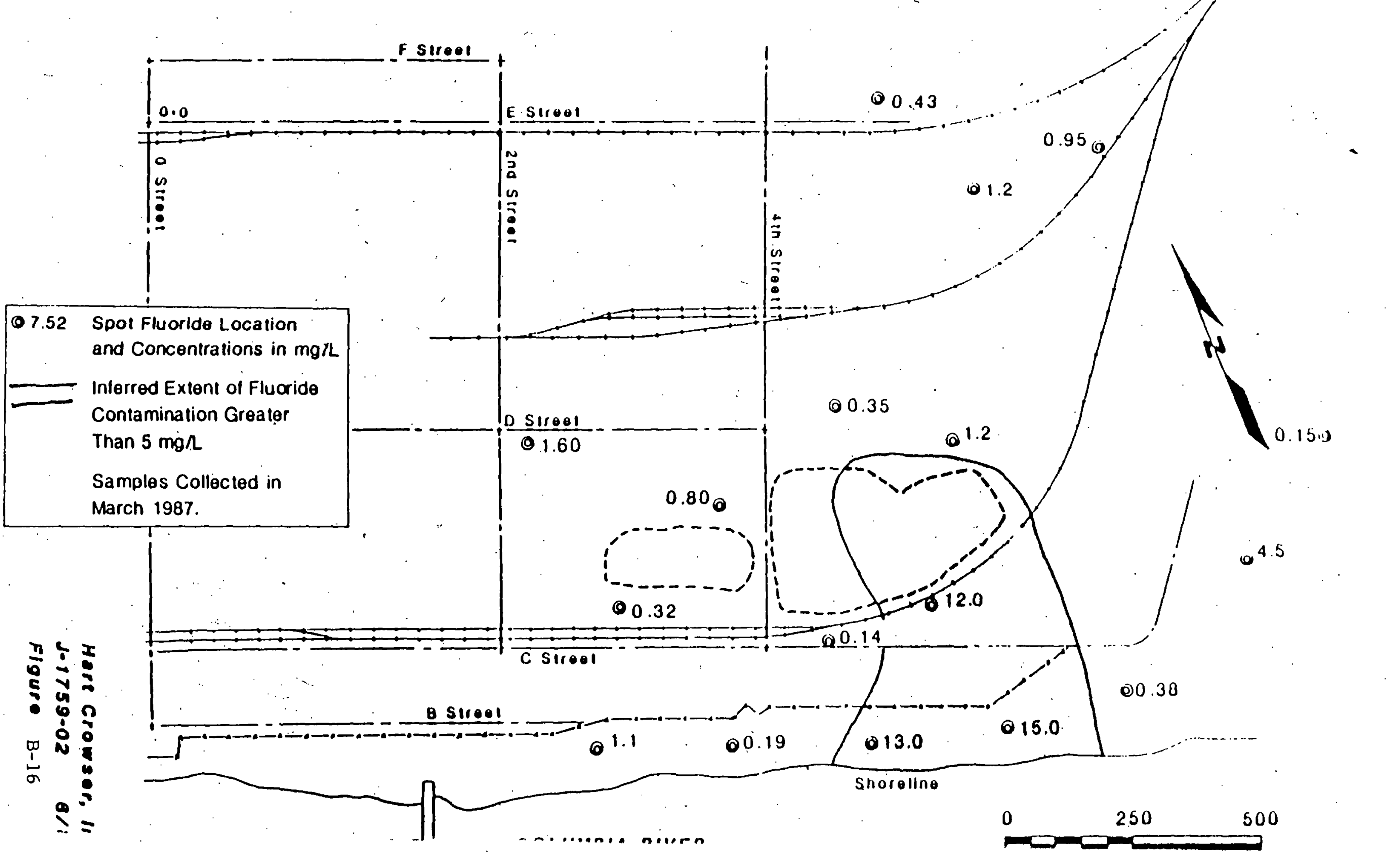
Figure B-15

Fluoride Concentration Map

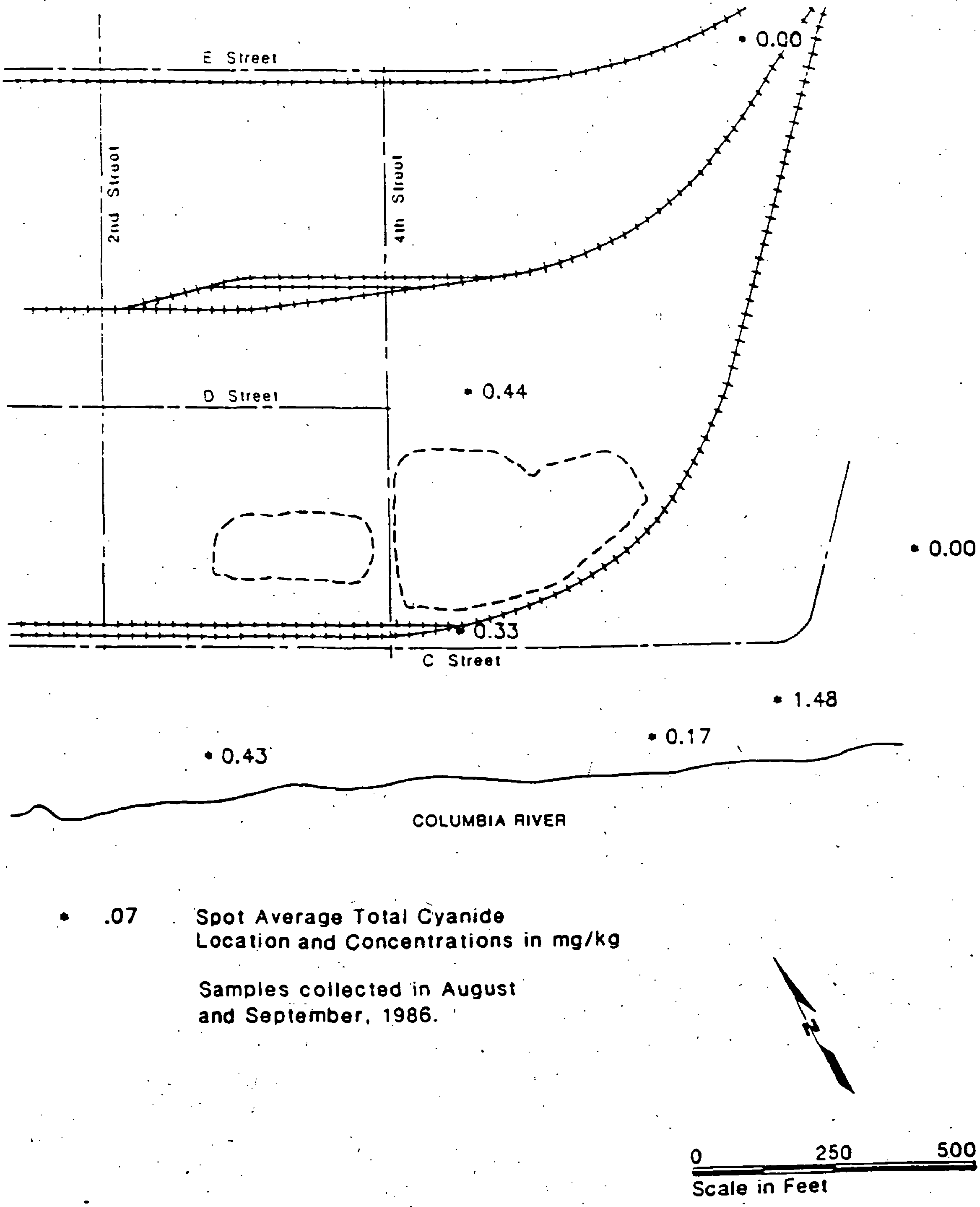
Concentrations in Groundwater from Deep Zone



Hart Crowser, I
J-1759-02 6/
Figure B-16

Total Cyanide Concentration Map

Average Concentrations in Soil Samples from Deep Zone



• .07 Spot Average Total Cyanide Location and Concentrations in mg/kg

Samples collected in August and September, 1986.

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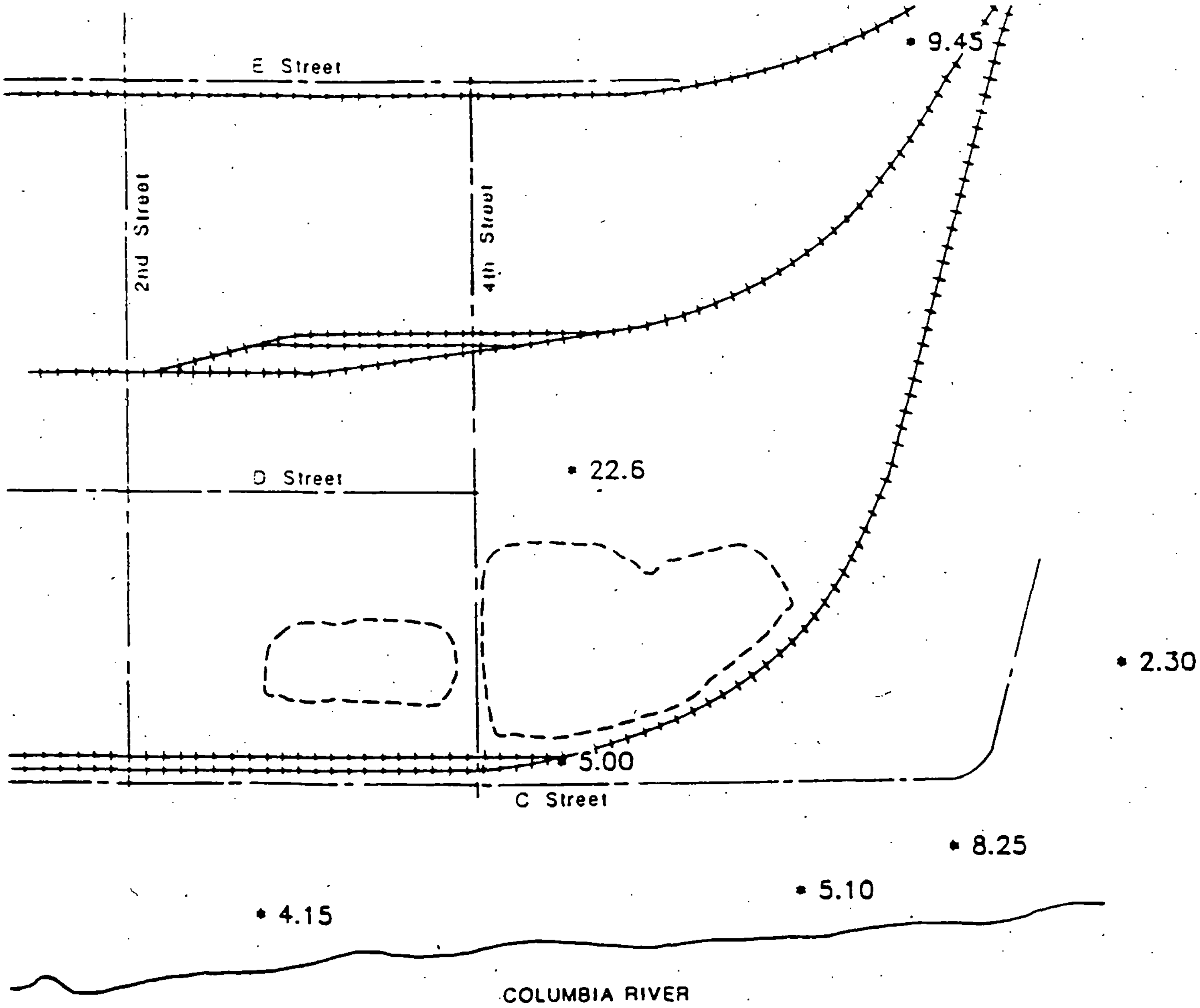
Figure B-17

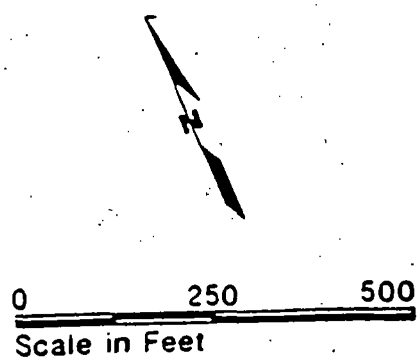
Fluoride Concentration Map

Average Concentrations in Soil Samples from Deep Zone



• 8.43 Spot Average Fluoride Location and Concentrations in mg/kg

Samples collected in August and September, 1986.



J-1759-02 June 19

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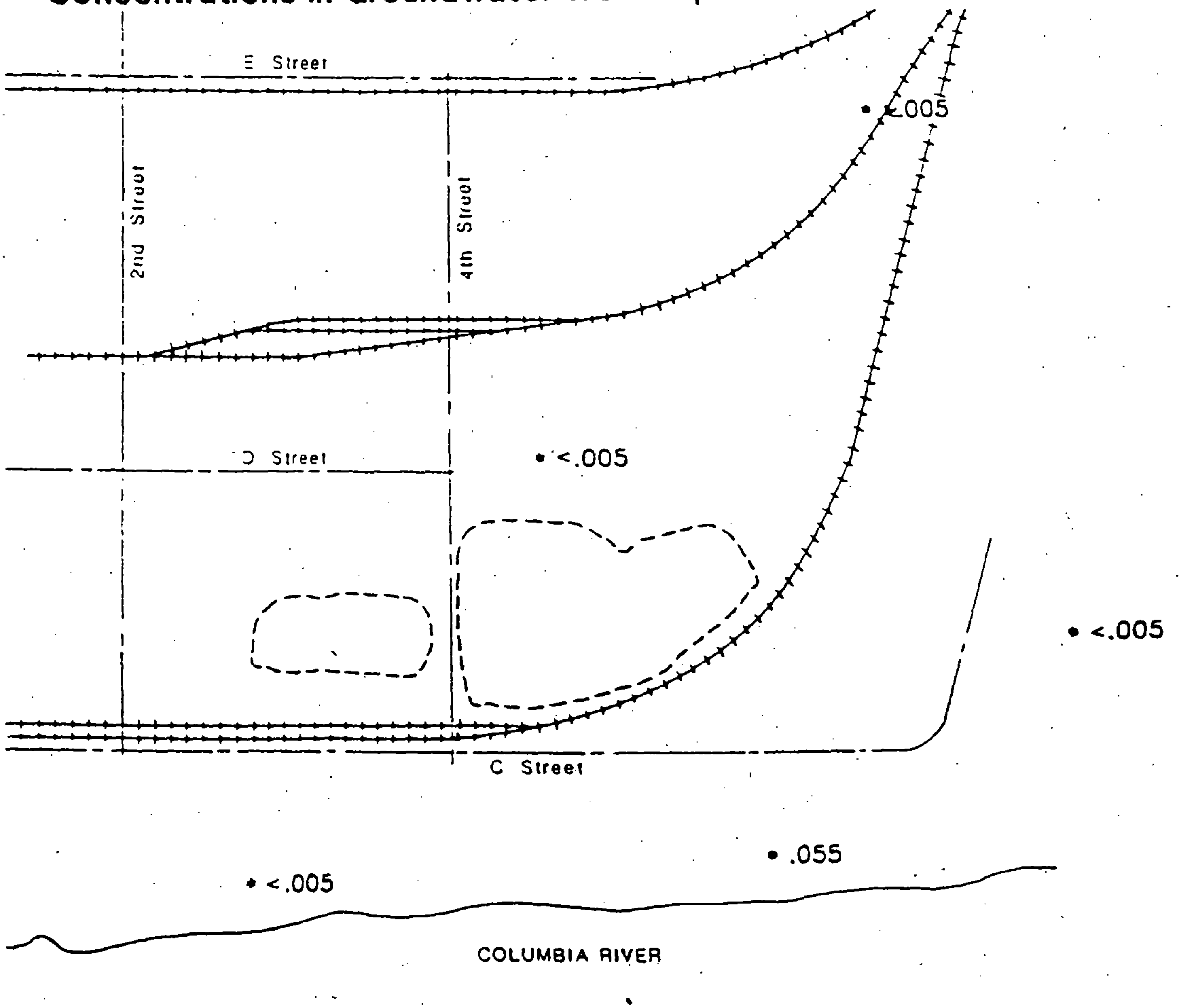
Figure B-18

Total Cyanide Concentration Map

Concentrations in Groundwater from Aquifer Zone



• .055 Spot Total Cyanide Location and Concentrations in mg/L

Samples collected in November, 1986.

0 250 500
Scale in Feet

J-1759-02 June
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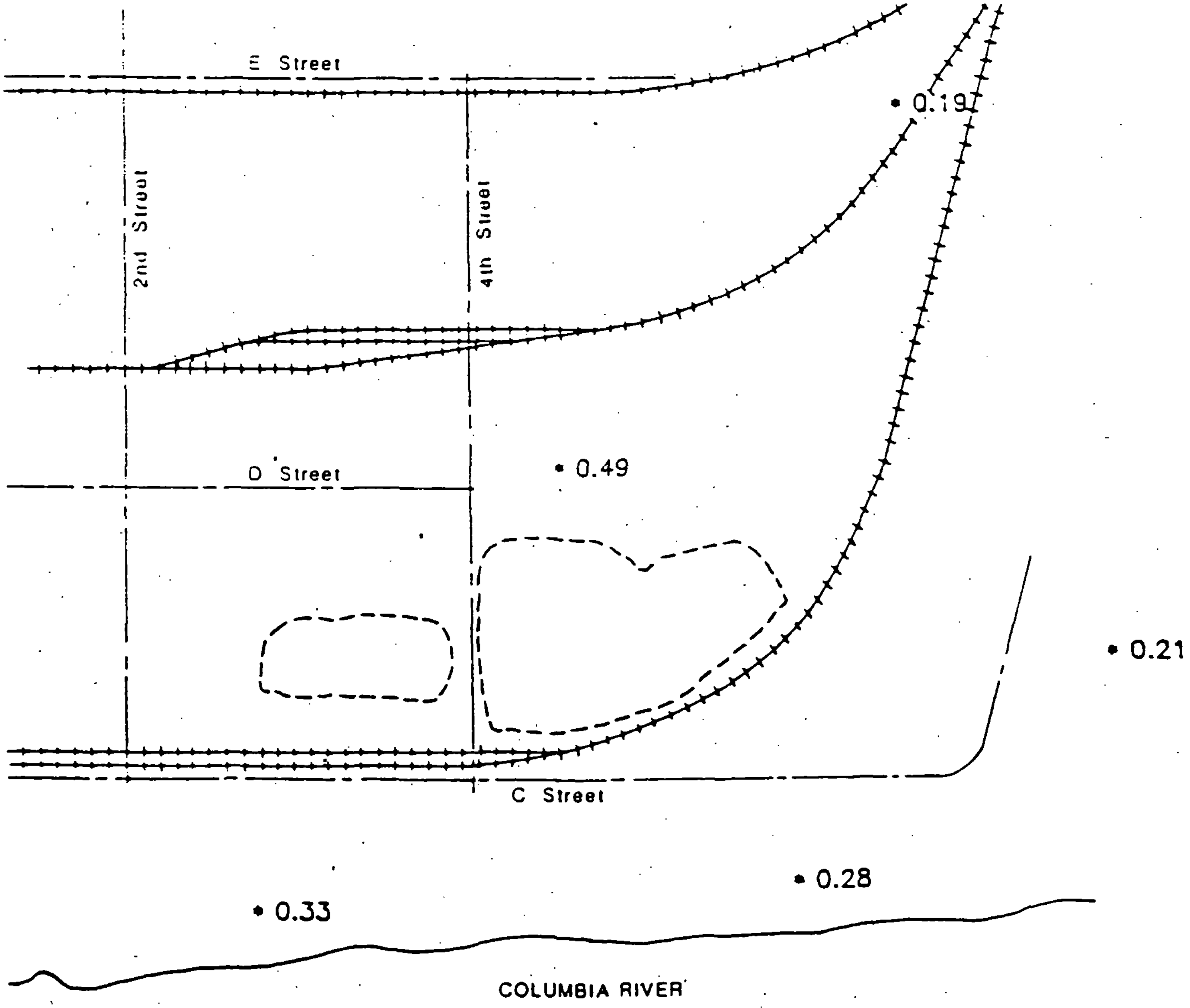
Figure B-1

Fluoride Concentration Map

Concentrations in Groundwater from Aquifer Zone



• .52 Spot Fluoride Location and Concentrations in mg/L

Samples collected in November, 1986.

0 250 500
Scale in Feet

J-1759-02 June 198
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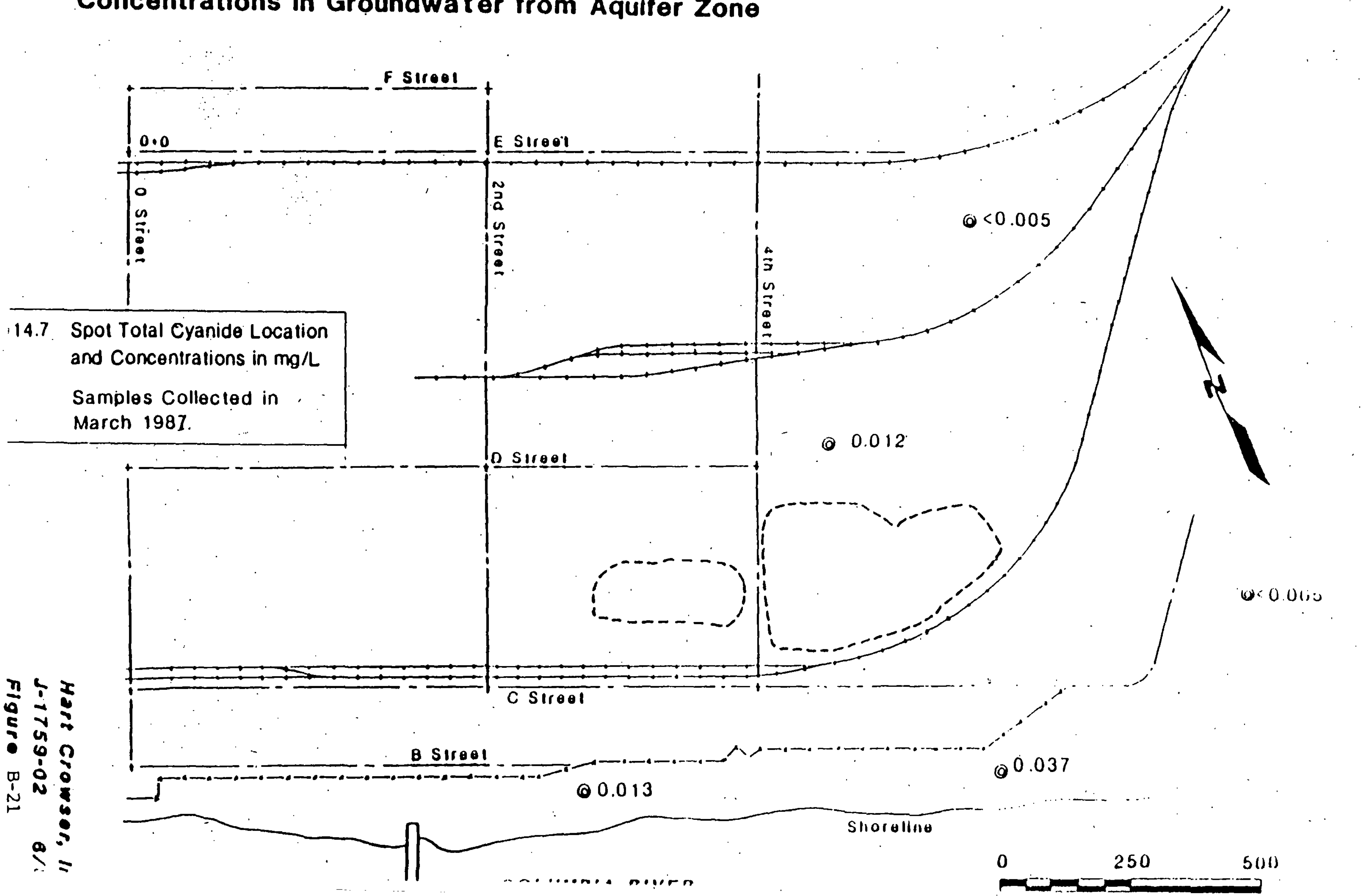
Figure B-20

Total Cyanide Concentration Map

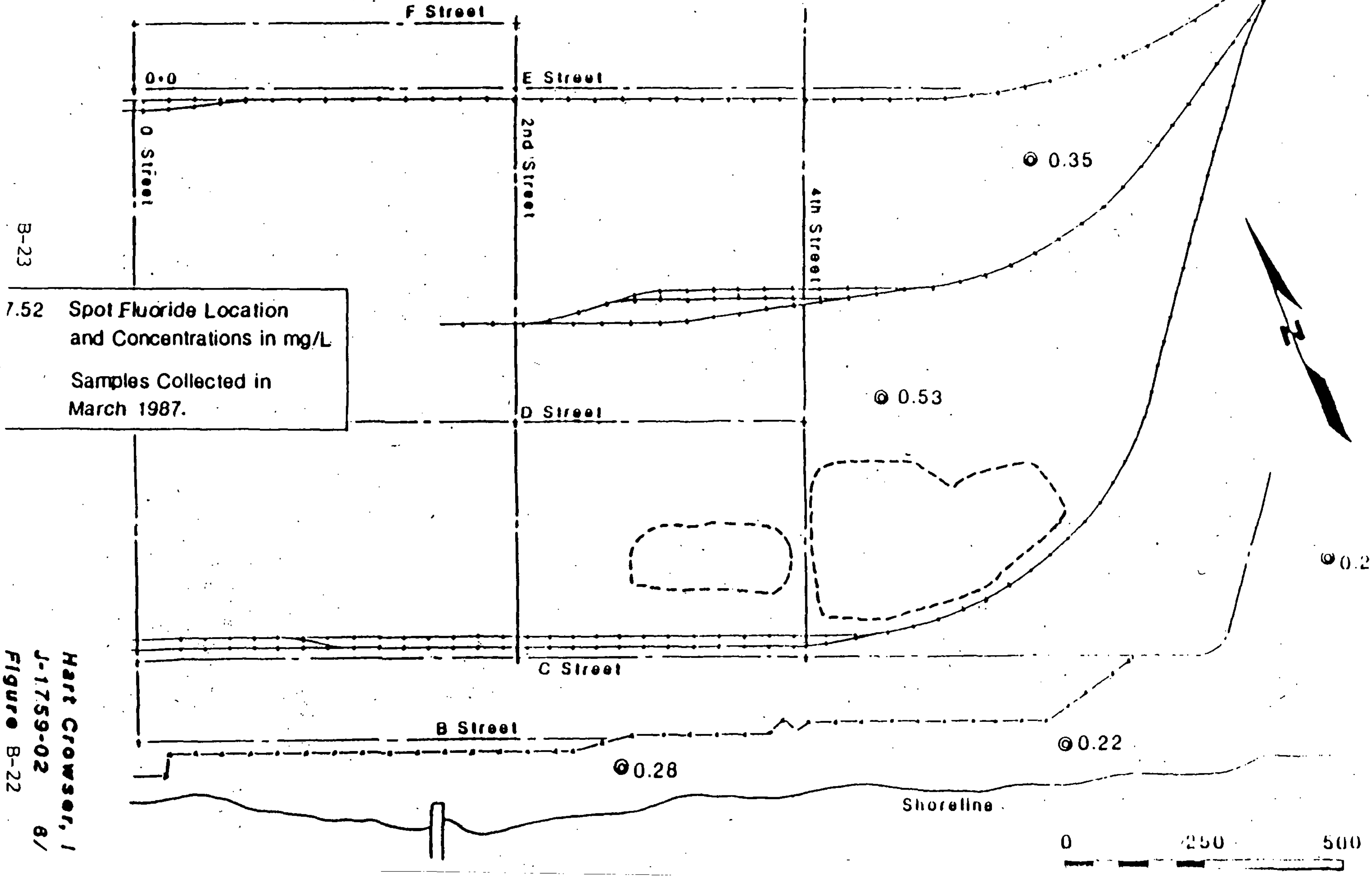
Concentrations in Groundwater from Aquifer Zone



Hart Crowser, In
J-1759-02 6/
Figure B-21

Fluoride Concentration Map

Concentrations in Groundwater from Aquifer Zone



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Hart Crowser, I
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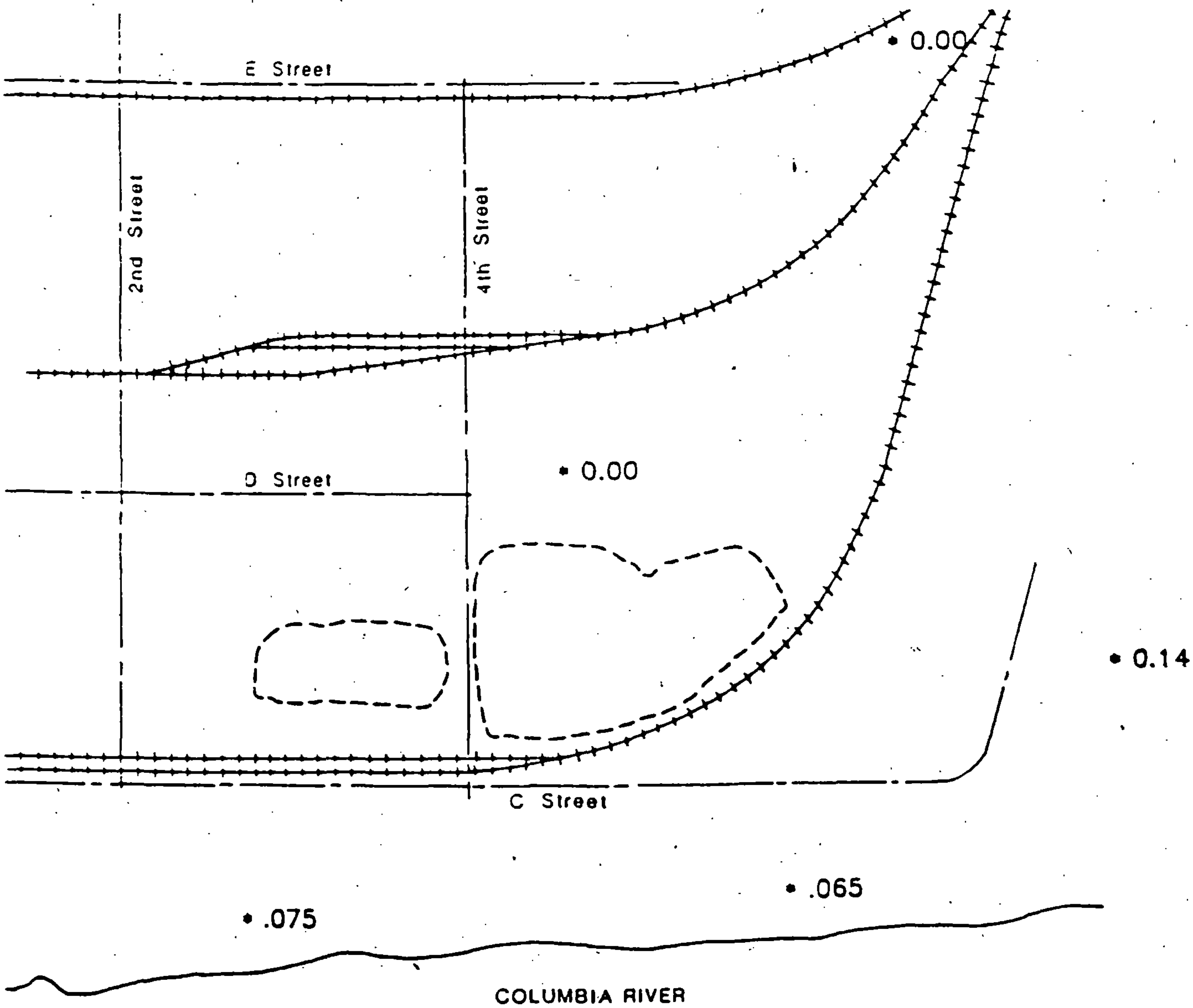
Figure B-22

Total Cyanide Concentration Map

Concentrations in Soil Samples from Aquifer Zone



• .07 Spot Total Cyanide Location and Concentrations in mg/kg

Samples collected in August and September, 1986.

0 250 500
Scale in Feet

J-1759-02 June 1

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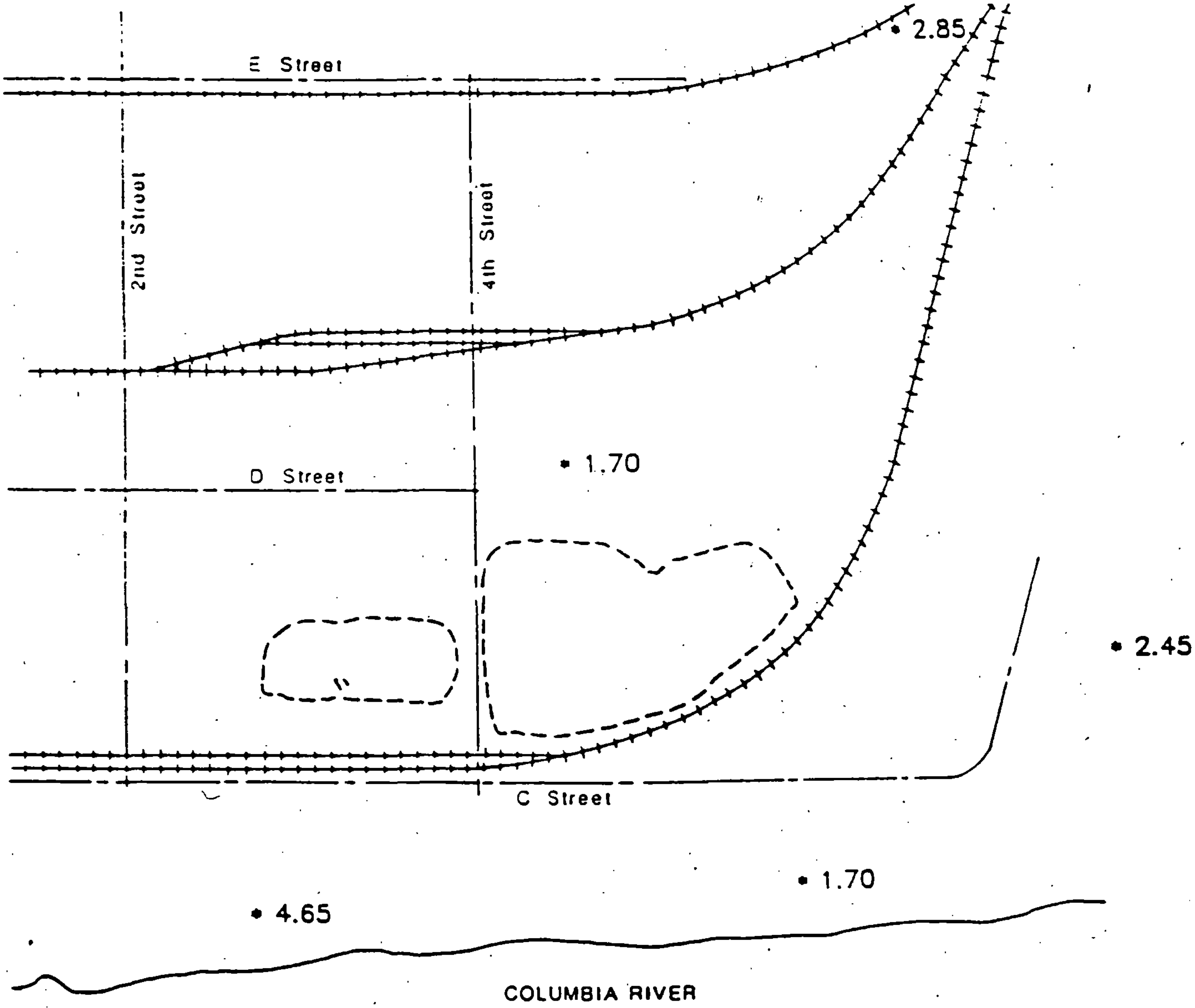
Fluoride Concentration Map

Concentrations in Soil Samples from Aquifer Zone



• 8.43 Spot Fluoride Location and Concentrations in mg/kg

Samples collected in August and September, 1986.

0 250 500
Scale in Feet

J-1759-02 June 19
HART-CROWSER & associates i